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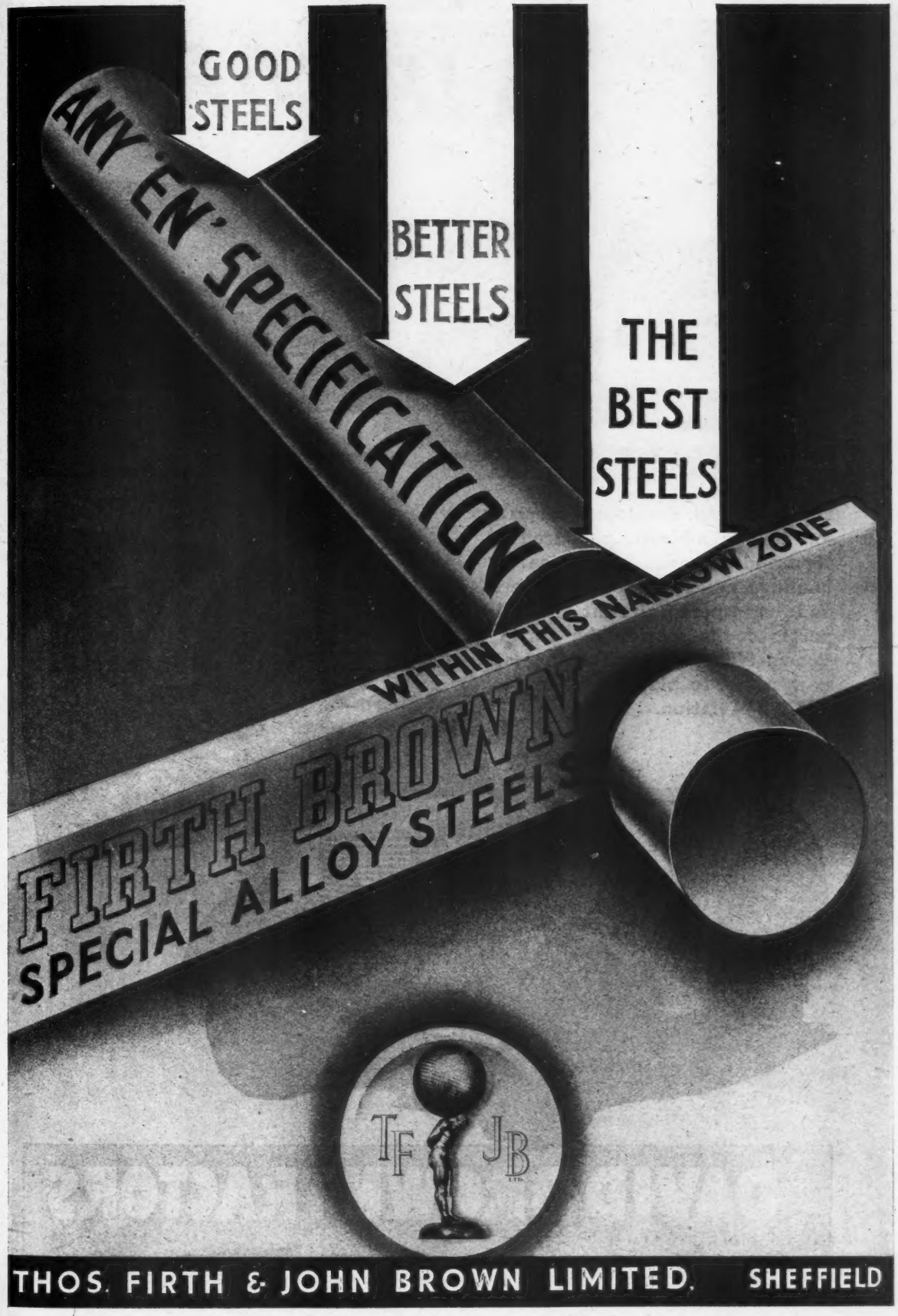
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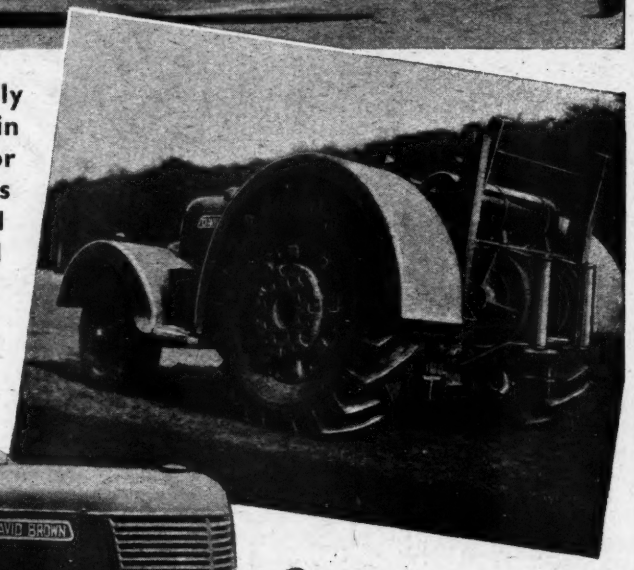

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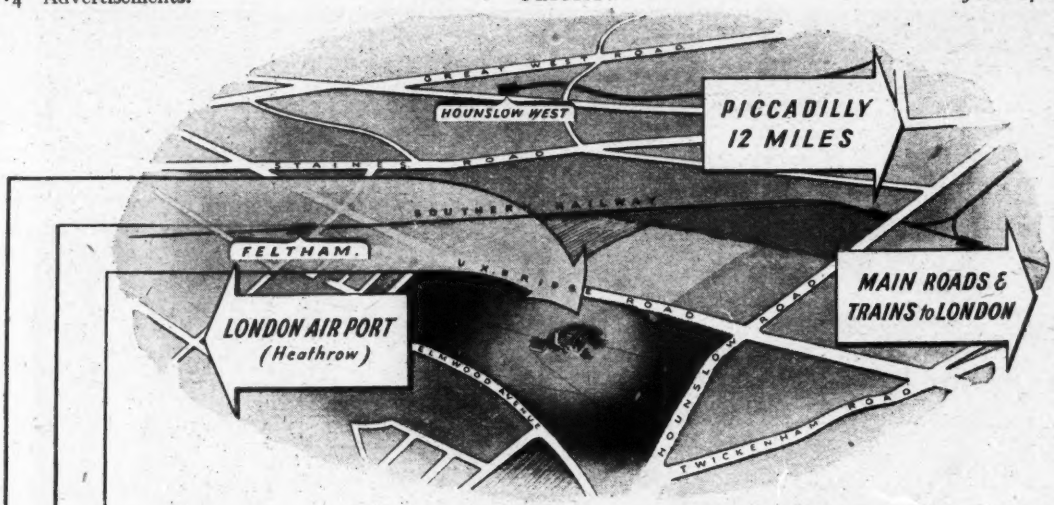

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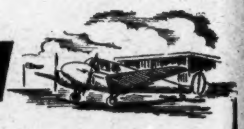

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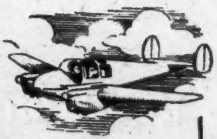

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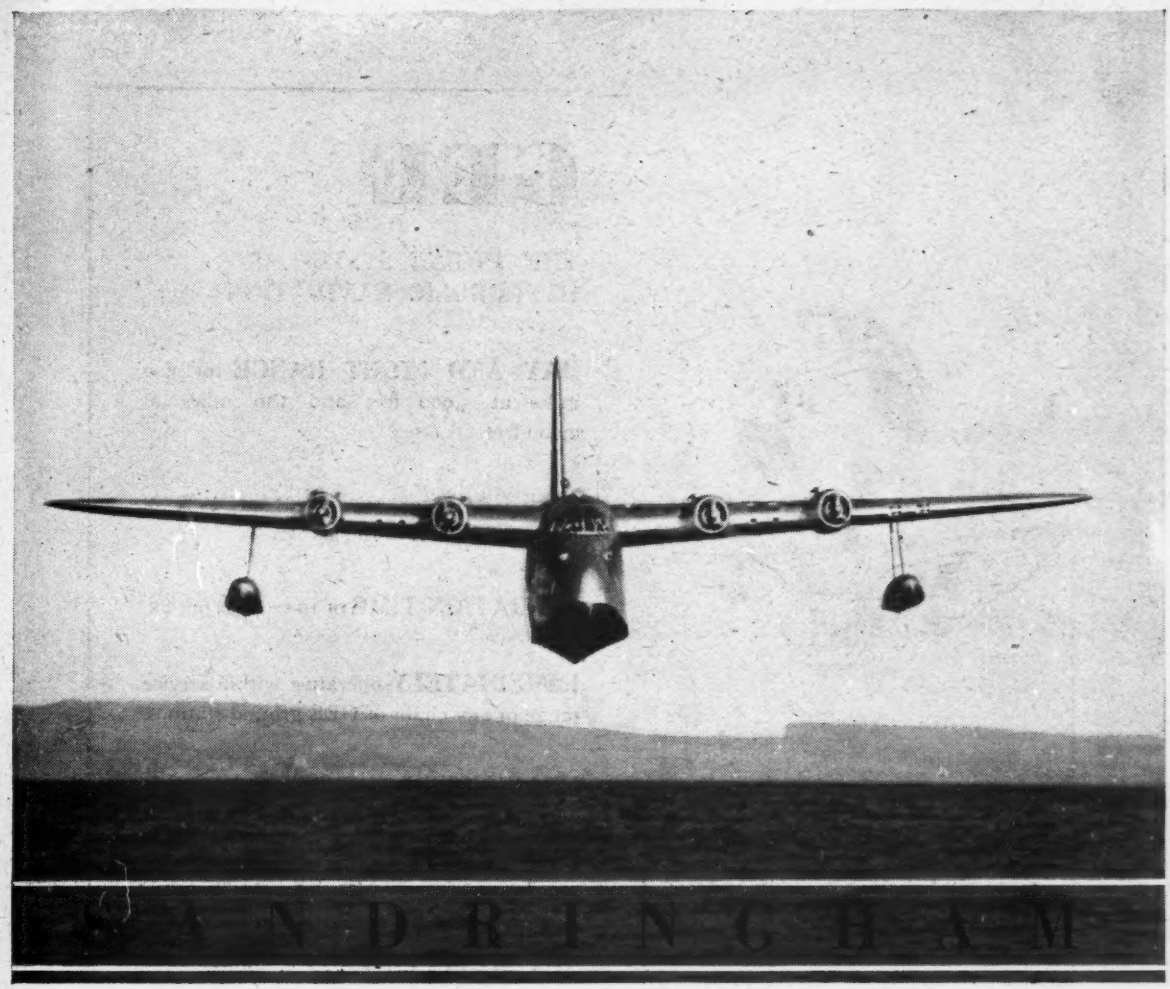

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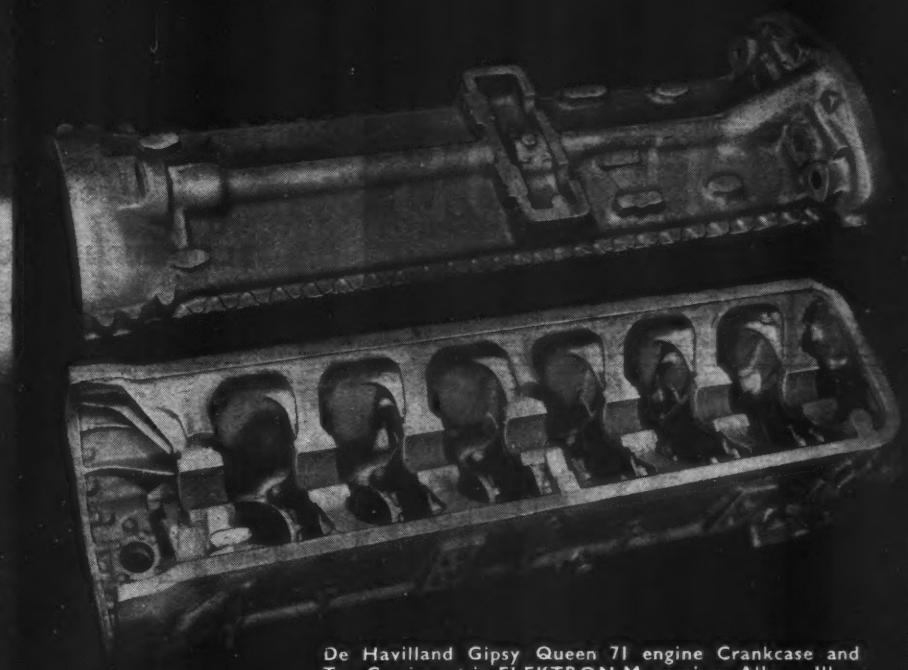

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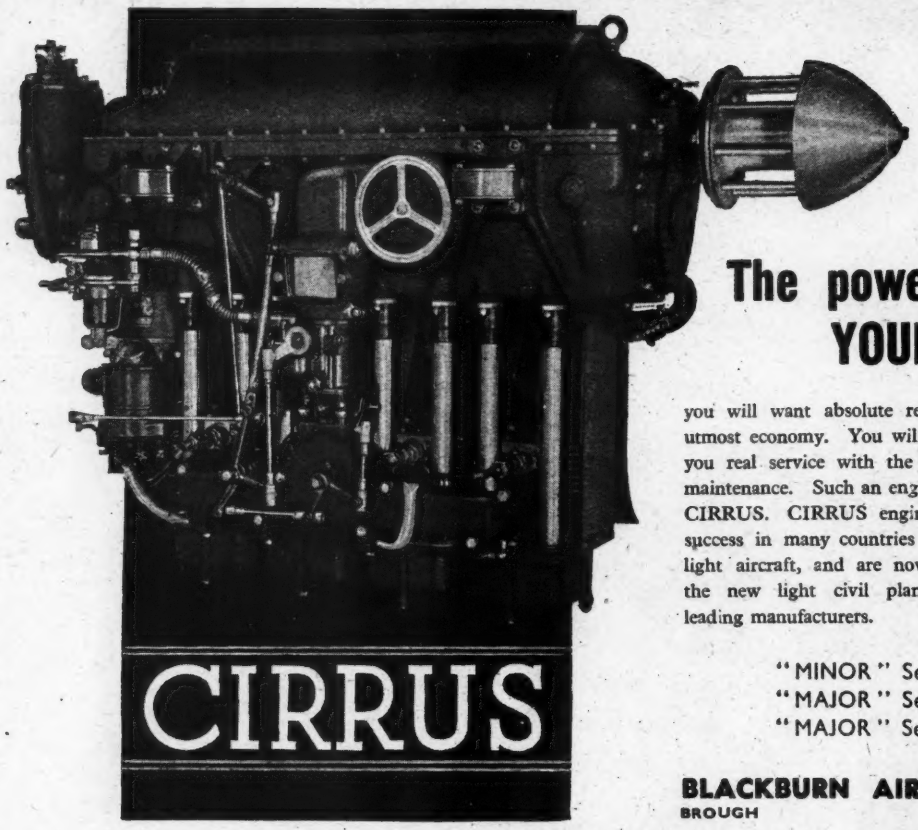

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Art Editor - - JOHN YOXALL

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams : Flightpres, Sedist, London. Telephone : Waterloo 3333 (50 lines.)

COVENTRY: 8-10, CORPORATION ST. Telegrams : Autocar, Coventry, Telephone : Coventry 5210.
BIRMINGHAM, 2: KING EDWARD HOUSE, NEW STREET. Telegrams : Autopress, Birmingham. Telephone : Midland 7191 (7 lines).
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Registered at the G.P.O. as a Newspaper

No. 1957. Vol. XLIX. June 27th, 1946 Thursdays, One Shilling.

The Outlook

Helicopter Configuration

WHILE the small single-rotor helicopter has been flying for several years in a variety of forms, and has thereby accumulated a considerable fund of knowledge on the many problems connected with rotary-wing flight, not a great deal has been done in the way of developing the large weight-lifter.

It appears probable that the American Piasecki PV-3 is the largest transport helicopter flying to-day. This machine, it will be recalled, is remarkable for the fact that its two rotors are placed in tandem. No doubt this arrangement makes for aerodynamic efficiency.

During development work carried out by G. and J. Weir some years ago it was found that, although two rotors placed side-by-side had many advantages from the control point of view, helicopters with this rotor arrangement were very sensitive fore-and-aft. It would be interesting to know if the tandem arrangement of the PV-3 results in an excessive swing laterally. As the main weights are considerably underslung in relation to the rotors, one would expect something of the sort to happen. If the PV-3 gives no trouble in this respect, there would appear to be much to be said for the tandem rotor arrangement.

The main limitation on the weight that can be lifted by rotating wings is imposed by rotor diameter, and if even greater loads are to be carried, multiple rotors seem to be inevitable. Obviously these can be arranged in several ways, one of the simplest being a triangular configuration, with two side-by-side rotors in front and a single rotor at the tail. Such a machine has been detively unimportant. This fact is reflected in the designed by the Cierva Autogiro Company specifically for the destruction of pests, for which the helicopter is basically suited, and for which horizontal speed is comparasign of the Cierva "Air Horse," a description of which will be included in next week's issue. On the following page, incidentally, there are photographs of the jet-controlled Cierva W.9, which was shown at Southampton last Saturday.

Heads I Win ....

IT would be easy to say that the charter services "are meeting every obstruction that can be put in their way"—which were the words used by one of the Opposition speakers during the third day of the Standing Committee debate on the Civil Aviation Bill. This would be an exaggeration, but it is true that the charter concerns are, legally speaking, in an extremely difficult position. They have, in the Bill, been given a certain amount of rope, but however hard we may try, it is impossible to see quite clearly where the rope ends, or even to be sure that it will not be shortened at any moment.

The question of what a charter company can or cannot actually do seems to be almost impossible to answer. Within the limits of the Act's direct refusal to allow them to operate scheduled services, the charter companies can only proceed by trial and error—with a very considerable penalty for error. But what, in fact, is a scheduled service? No one can really know the answer, though the Attorney-General has explained it as "a service involving a series of journeys between point and point, amounting to a systematic service, and operating in such a manner that it is available to members of the public." That seems to be clear enough, but what is the position, say, of a travel agency which charters an aircraft for a certain day and time, and then advertises for passengers? This would, we are only too sure, be at least the subject of a severe reprimand. Again, the organization of any return load is, we understand, tantamount to the running of a scheduled service, and is not, therefore, permitted. Yet neither of these constitutes a "systematic series of journeys" in any reasonable sense of the term. It would seem that "regular" is the operative word.

At the moment, the operators of charter services who wish to keep carefully within the law are involved daily in a series of question-and-answer conversations with various departments of the Ministry of Civil Aviation

and others. So far as one can learn, a tremendous amount of energy and time is wasted in this way, and the mere business of organizing the trip itself forms only a fraction of the effort involved. No charter company can afford so to waste energy or, least of all, time, but the position might possibly be even worse if a series of specific rules and regulations were formulated.

If the matter involved only one or two small private operators it would still be important as one of principle, but there is in existence at least one large organization and we hear rumours of another of a similar size which is to be organized by the railway companies and a well-known charter operator of pre-war days. The whole thing, therefore, may reach the proportions of internecine strife.

With the best will in the world neither the Minister nor his legal advisers can satisfactorily sort out the situation, or re-word the Act in such a way that it is clear. The air services are being nationalized, and nationalization is the practical expression of a theory, whether good or bad. No rules, regulations, good advice, or even goodwill can alter the fact that, from the moment when the Act becomes law, the Government is all-powerful. And the charter companies must operate from hand to mouth, depending finally on Government favours.

Eisenhower and the Air

GENERAL EISENHOWER'S report to the Combined Chiefs of Staff on the operations of the Allied Expeditionary Force appears to have been regarded by many as a vindication of personalities and a refutation of unjust assertions, but it can be acclaimed a masterly exposition of strategy. Not the least significant of General Eisenhower's pronouncements is that the primary cause of the German defeat in the Battle of Normandy was the failure of the *Luftwaffe* in the Batfle of the Air. This he supports with reference to the bombing of aircraft factories, which deprived the *Luftwaffe* of most of its productive capacity and of adequate reserves necessary to maintain front-line strength; to the overwhelming mastery in the air, without which D-Day would have been a "most hazardous if not impossible undertaking"; to the disruption of enemy communications; and to the air assault on the oil industry.

The cardinal importance of oil in a modern war, and, indeed, of the ability of air power to prevent its production and delivery, is particularly emphasized.

Statistics in the report are not always of a detached impersonal nature. Thousands of aircrew will feel a glow on reading that by D-Day no less than seventy-four bridges and tunnels leading to the battle area were impassable. Thus General Eisenhower gives credit to tactical, as well as strategical, air power.

The report of this great soldier will remain as a splendid tribute to air power and as confirmation of views so often and so earnestly expressed in these pages.

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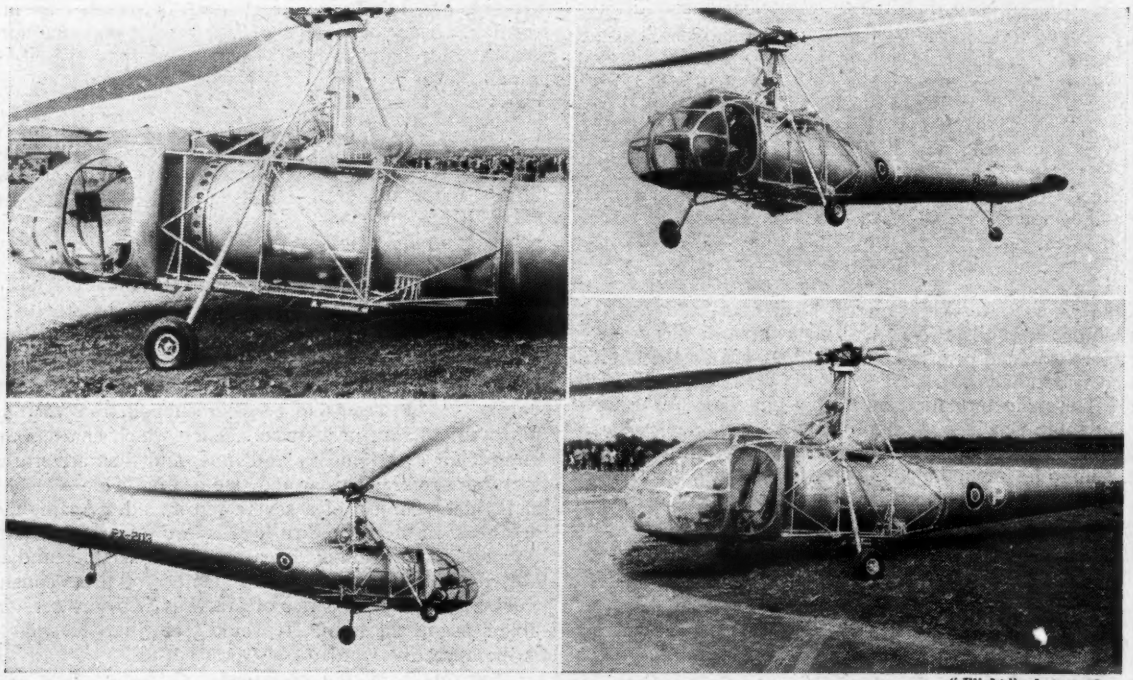


"Flight" photographs.

JET CONTROLLED: Four views of the Cierva W.9 research helicopter which was on show at Southampton last Saturday. Torque reaction and directional control are provided by means of a laterally-directed jet in the tail. The "urge" for the jet is supplied by exhaust and the fan used to cool the Gypsy Queen, and is controlled, through the pilot's rudder pedals, by varying the incidence of the fan blades.

Southampton Air Display

Air League Organizes First Full-scale Post-war Pageant : Cierva W-9 Helicopter Shown

AIR MINISTRY BLESSING: Lord Winster flew down to Eastleigh to see the display and to pronounce the official opening words.

"Flight" photograph.

WHATEVER may have been the weaknesses of the air display at Southampton last Saturday, these were suddenly not the fault of the organizers. Within its limitation the show ran like clockwork as the natural culmination of an immense amount of hard work. There were no gaps in the programme, the weather was perfect, and the crowds (ten thousand instead of the hoped-for twenty thousand) stayed until the end.

The primary limitations were straightforward enough. Following a veto imposed by the Ministry of Supply it was only possible for the manufacturers to show prototypes—and such aircraft could not possibly be made easily available for such an event. Hence the fact that "trade" support was poor, at least so far as modern military aircraft were concerned. With the exception of the home-grown Spitfire and Spiteful, almost the only military types on show were those flown individually or collectively by the R.A.F. and the Naval Air Arm, both of whom co-operated magnificently. Without the efforts of B.O.A.C. and Vickers, transport types of a more serious kind would have been almost entirely absent.

Since the pageant was planned primarily with the idea of public air education, this was more than a pity. Whether the public can be so educated by means other than the slow process of habit-formation, and whether air pageants really are in the least effective for this purpose is another matter. People hardly go to circuses in order to become animal-lovers, or to dirt-track race meetings to be encouraged to use motor bicycles; they go to be entertained or, sometimes, in the hope that there will be a splendid accident.

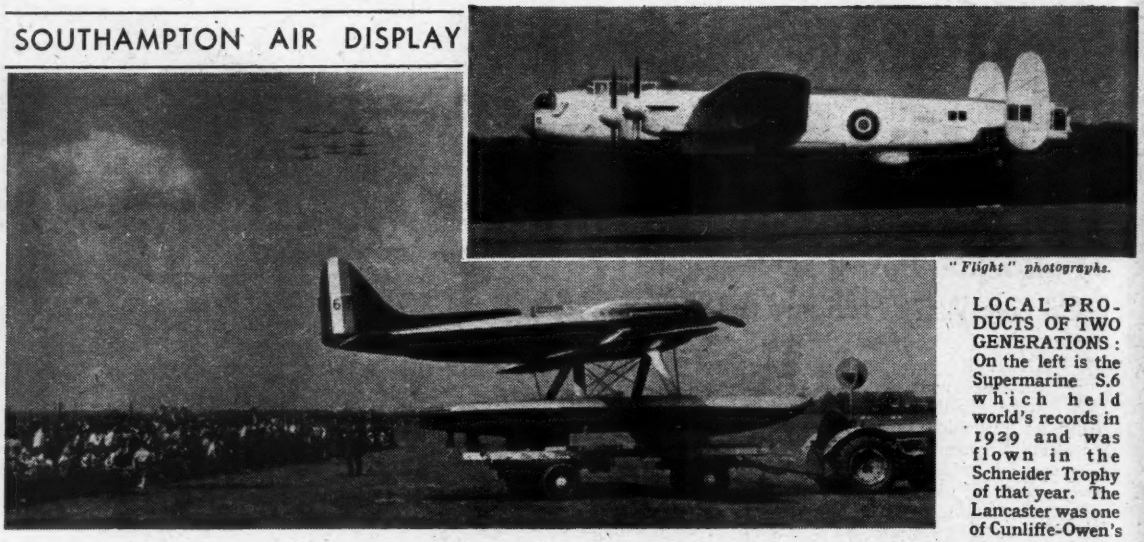
However, if education was required the public saw some very nice flying by the Services; they saw aircraft of Channel Island Airways—which, we hear, are not likely to fight nationalization from their island fortress—coming and going; they saw the Vickers Viking in the air towards the end of the display; they saw the Bristol Wayfarer; and they saw both the Avro York and the Short Hythe boat flown by B.O.A.C. crews. The Hythe demonstration was singularly impressive as the twenty tons of big-hulled boat sailed slowly by, flaps half extended, at an altitude of 50ft or so.

For the prototypes there was the so-far-secret Cierva W-9 Helicopter flown by Mr. H. A. Marsh, who chose Saturday afternoon to put in a little test flying. The correction of rotor torque-reaction is ingeniously effected. To cool the Gypsy Queen engine, a multi-blade cooling fan, having variable pitch blades is carried in front of the engine. The whole of the cooling air, after leaving the power unit bay, is carried along the lengthy fuselage, which virtually becomes a duct, and is therein

"Flight" photographs.

SOME PERSONALITIES AT THE PAGEANT: In the picture above are Mr. H. P. Folland, M.B.E., the chairman of the Southampton branch of the Air League, and Air Vice-Marshal S. D. MacDonald, C.B.E., D.F.C., the A.O.C. of 11 Group. Below are, from left to right, Group Capt. J. J. Jeffs, Sqn. Ldr. L. F. Payne (airport manager and pageant organizer), Capt. A. G. Lamplugh, Mr. W. P. Savage, Mr. J. W. Cameron, respectively general manager and service manager of Napiers, and Mr. Eric Greenwood, chief test pilot of Glosters, who has been awarded the O.B.E. in the Birthday Honours.

SOUTHAMPTON AIR DISPLAY



"Flight" photographs.

LOCAL PRODUCTS OF TWO GENERATIONS: On the left is the Supermarine S.6 which held world's records in 1929 and was flown in the Schneider Trophy of that year. The Lancaster was one of Cunliffe-Owen's

heated by mixture with the exhaust gases. At the tail of the fuselage the mixture of cooling air and exhaust gas emerges at right angles as a lateral jet.

The jet reaction is controllable by means of the rudder-bar, which varies the pitch of the fan blades. The normal setting of the fan produces a jet stream which is just sufficient to correct the torque reaction of the rotor blades. When the efflux is varied by control of the fan, the jet reaction forces can be unbalanced at will. This promising system of control is the subject of a joint patent by C. G. Pullin and G. and J. Weir, Ltd.

The pageant was due to be opened by the Minister of Civil Aviation at 2.30. He was, however, somewhat late in arriving by air, and his words of blessing over the loudspeakers were unfortunately interrupted by the contra-airscrew scream of Mr. Jeffrey Quill's Spitfire XXIV when he started his demonstration, according to plan, soon after 2.35. He was to have flown the Spiteful, but trouble was experienced with its cartridge starter and he was forced to clamber, at the last minute, from one aircraft to the other. However, as far as the demonstration was concerned, nothing can have been lost, since the XXIV is, in certain conditions, probably more handleable in this type of flying; his very low level fly-pasts and reversed upward rolls were particularly impressive.

Thereafter, fighters were individually represented by, in turn, a Service Meteor III—in place of the IV prevented by the M.S.A.P. veto—an R.A.F. Vampire and an N.A.A. Firebrand. The Meteor, from No. 245 Squadron, Colerne, and flown by Ft. Lt. A. J. Eills, finished its vortex-producing show by flying inverted at about 500 ft across the airfield. The Vampire from No. 247 Squadron (Ft. Lt. C. H. Carter) was notable primarily for its thunderclap arrival at low level from nowhere at all, while the Firebrand demonstration was really an extension of the formation show put on just previously by No. 813 Royal Naval Air Squadron from Eastleigh itself. Beautifully tidy were formations of Lancasters (No. 35 Squadron), Spitfires IXs (No. 164 Squadron), and Meteors (No. 56 Squadron); these concluded the very considerable Service effort which did so much to make the afternoon a success. Separately, Cunliffe-Owens put up one of their Lancasters.

However well executed may be the demonstrations of smaller civil types, these are never likely to impress a crowd in Roman holiday mood, and the afternoon would have been somewhat bare without Service support. The Miles Gemini, Messenger and Aerovan, a Percival Proctor and the Airspeed Consul, were all shown and flown, with the Reid & Sigrist Desford twin-trainer, to provide, after the Auster, an aerobatic display of the more pleasantly old-fashioned kind. Meanwhile, a Supermarine S.6, looking brand new and hardly dated on its trailer, was towed past the spectators. Uninformed superficial observers of this seaplane could hardly have been blamed for thinking that design had failed to go very far very quickly in fifteen years. This particular S6 had been "disqualified-second" in the 1929 Schneider Trophy race and had taken the 50 and 100 km. world's records.

During most of the afternoon a very continuous running commentary was provided by Mr. Charles Gardner of the B.B.C., and it was certainly a return to the pre-war appearance of such events to find Capt. Lamplugh and Group Capt. "Jimmy" Jerfs back in their flying control "beats" in assistance of Sqn. Ldr. L. F. Payne, the Southampton airport manager, who had the somewhat thankless task of organizing the affair.

FORTHCOMING EVENTS.

June 30th.—Northern Heights Model Flying Club Gala. Langley airfield, Nr. Slough, Bucks.

July 1st.—Royal Society's Empire Scientific Conference; first Oxford meeting includes "Modern methods of mapping and exploration by air."

July 9th.—Aero Golfing Society; meeting at the Royal Berkshire Golf Club, Ascot.

August 22nd.—Model Engineer Exhibition opens at the New Horticultural Hall, Vincent St., Westminster, London, W.1. (11 a.m.)

Sept. 9th.—Ministry of Civil Aviation demonstrations of technical radio equipment. More details pending.

PASSING OF A PIONEER

BY the recent death of Mr. D. H. Emby the British aircraft industry has lost one of its pioneers in metal aircraft construction. Some time after forming the Steel Wing Company, Mr. J. D. Mooney, who died a short time ago, called in Mr. Emby to act as chief engineer. He did splendid work in developing the technique of making wing spars and ribs of high-tensile steel strip. When the Steel Wing Company was merged into the Gloster Aircraft Company, Emby had much to do with the changeover from wood to steel.

For a time Emby tried to rescue the British Aircraft Manufacturing Company, which had got into difficulties, but there was insufficient working capital left, and he was unsuccessful. When that firm closed down Emby returned to his whole-time interest in James Taylor (Chertsey), Ltd., builders of high-speed motor vessels.

During the worst of the Blitz he stuck to his work though he was at times dangerously ill. It is said that on one occasion the shipwrights held a prayer meeting for his recovery.

A friend of Emby's, who has worked with him and knew him intimately, says: "His example and influence will be felt down the years. He avoided self-advertisement, and it is for others to remember and speak of his great qualities."

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All the Air Routes linking Great Britain with the Empire are now operated by aircraft fitted with Rolls-Royce Power Plants. These include the Springbok service to South Africa; the Indian and Australian services; and T.C.A.'s Transatlantic service. The aircraft on the British-South American route are also powered by Rolls-Royce engines.

Although the aircraft at present used are interim types, which are in effect developments of British bombers and military transports—Avro Lancastrians and Yorks—they are operating with a very high standard of reliability and at speeds which are competitive with anything else in the world.

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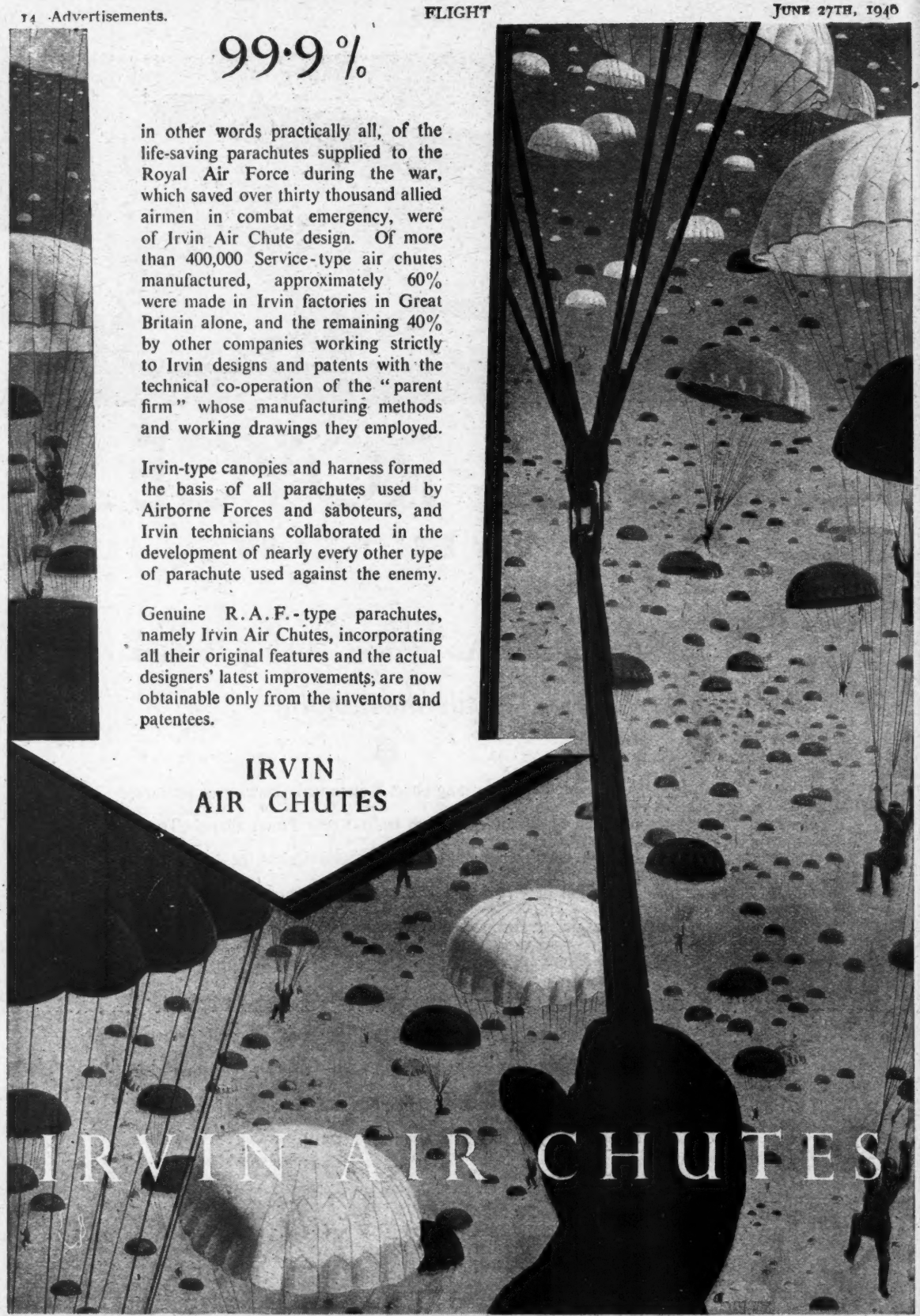
in other words practically all, of the life-saving parachutes supplied to the Royal Air Force during the war, which saved over thirty thousand allied airmen in combat emergency, were of Irvin Air Chute design. Of more than 400,000 Service-type air chutes manufactured, approximately 60% were made in Irvin factories in Great Britain alone, and the remaining 40% by other companies working strictly to Irvin designs and patents with the technical co-operation of the "parent firm" whose manufacturing methods and working drawings they employed.

Irvin-type canopies and harness formed the basis of all parachutes used by Airborne Forces and saboteurs, and Irvin technicians collaborated in the development of nearly every other type of parachute used against the enemy.

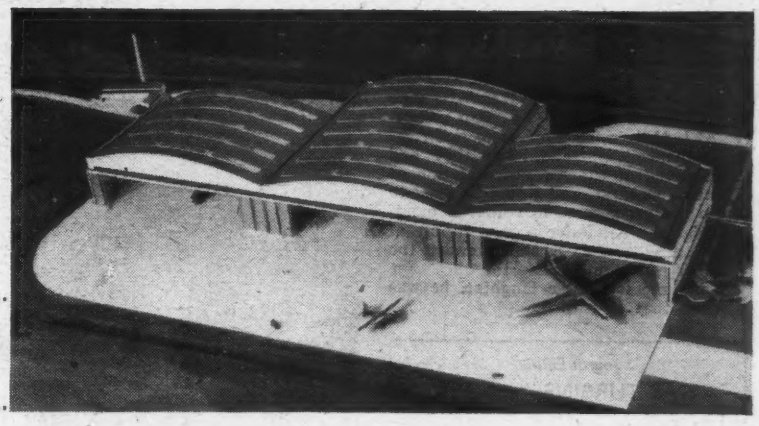
Genuine R.A.F.-type parachutes, namely Irvin Air Chutes, incorporating all their original features and the actual designers' latest improvements, are now obtainable only from the inventors and patentees.

IRVIN
AIR CHUTES



THE IRVING AIR CHUTE OF GREAT BRITAIN LTD., LETCHWORTH, HERTS, ENGLAND
Telephone No LETCHWORTH 884 Telegraphic Address : IRVIN, LETCHWORTH

HERE AND THERE



HOUSING THE 167s: This photograph of a model of the future assembly shops being built at Filton for Brabazon I development.

More Fireflys for the Netherlands

FOLLOWING the flying experience gained during six months with Fairey Firefly Mark Is, an order for a substantial number of Mark IVs has now been placed by the Dutch Ministry of Naval Affairs. These are, as in the case of the Mark Is, for duty with the Dutch Fleet Air Arm.

Preparing for the Brabazon

SOME interesting details of the new shops for the assembly of the Bristol 167s have recently been released. The floor area inside the "Assembly Hall"—as it is called—is almost eight acres in extent, and the concrete apron covers an area of six and a half acres. The building itself has a total capacity of 35,000,000 cubic feet. This is designed in three bays, which open on to the apron through power-operated doors, which permit three openings 300ft by 64ft. At the farther end of the bays are glazed walls which, combined with wall and roof lighting, will give daylight working conditions.

Production Ideals

THAT in this country aircraft should be "custom-built" in comparatively small quantities to users' requirements, as opposed to being mass produced, was the view put forward by Sir Frederick Handley Page, speaking at a luncheon of the Jig and Tool Makers' Association. Over-elaborate jigging and tooling for mass production, he said, frequently hampered design or, alternatively, resulted in wasteful scrapping of plant.

Gas Turbine Fabrication

THE advent of the gas turbine confronted works engineers with numerous production problems for which there were no existing precedents, and remarkable ingenuity was shown in solving them. In a series of articles—the first to describe the manufacture of aircraft gas-turbine units—*Aircraft Production* reveals the methods employed in the production of the de Havilland Goblin. In the July issue, now on sale, the fabrication of the impeller is described in detail.

Imperial Visitation

A NUMBER of "quasi-secrets" covering post-war plans were given prominence during a recent visit of some sixty Imperial Press Conference delegates to the Bristol Aeroplane Company.

They were shown items of test equipment for future jet engines delivering up to 12,000 h.p.; the Theseus—first of the Bristol jet-airscrew units—was shown under test; and the existence of the Proteus—which will power the first production versions of the Brabazon I—was revealed. The prototype Brabazon I, or Bristol 167, was also seen in course of construction.

Before they left again for London a flying display was staged, during which a Centaurus-engined Tempest, a Brigand, a Buckmaster and a Wayfarer were demonstrated.

Model Gala Day

NORTHERN HEIGHTS MODEL CLUB will hold their Gala Day at Langley airfield on Sunday, June 30th. Entrance will only be by programme or by membership card or badge of the Royal Aeronautical Society, Royal Aero Club, Air League or any model club. There will be no tickets on sale at the entrance.

They Didn't Mind if They Did!

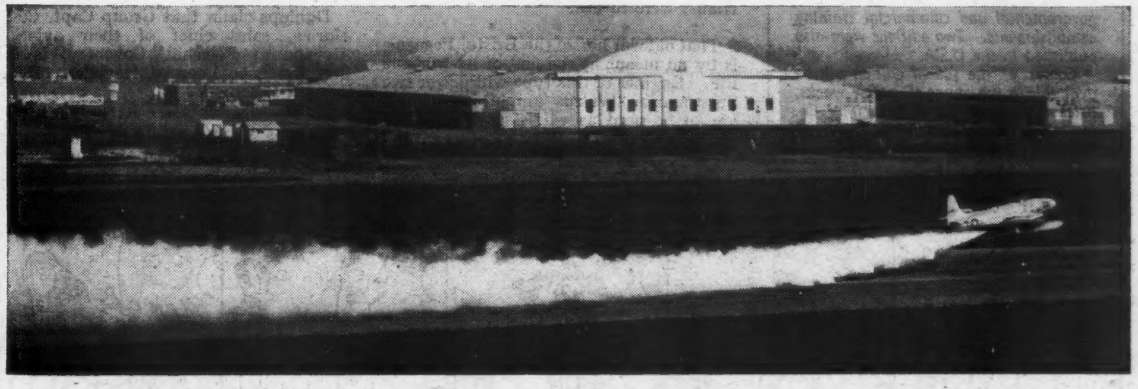
THE Dutch city of Schiedam has many gin distilleries, all of whom fought for the honour of supplying the liquor to be used in the christening of a new American airliner; the aircraft was to be named after the city and the ceremony performed by its burgomaster.

Deadlock was avoided by filling a stone jar with samples from each of the local distilleries, but the burgomaster had to swing it a second time before the jar consented to break. We should have hated to spill it, too!

Kilts and Comedy

QUESTION time in the Canadian House of Commons can be just as productive of "lighter moments" as can the spontaneous dialogue in our own Commons.

Recently a member wanted to know what had happened to the kilts once



ROCKET-ASSISTED JET: Two JATO units, developing a total thrust of 2,000 lb. for a period of 12-15 seconds, are being used here in one of a series of tests made, with the Lockheed P-80, by the U.S. Air Technical Service Command. With the P-80's own General Electric I-40 turbine giving 4,000 lb. of thrust, the run, lightly loaded, was reduced to 395 yards.

HERE AND THERE

worn by the disbanded R.C.A.F. pipe band, and was told by Grp. Capt. V. S. J. Millard, staff officer to R.C.A.F. Maintenance Command, that they had been stored at the Air Force station at Trenton, Ontario, and would be used to equip a future permanent volunteer band.

"Has the Air Force a good supply of moth balls?" asked Alistair Stewart, the member for Winnipeg North.

Amid the inevitable laughter, he was assured that it had.

Fourth Edition

GAS TURBINES and JET PROPULSION FOR AIRCRAFT

By G. Geoffrey Smith, M.B.E.

A NEW edition of this book, greatly enlarged and profusely illustrated is now in the press. Twenty-one chapters cover the development of the aircraft gas turbine, in both jet and airscrew types, describe current and projected turbine-propelled aircraft, and discuss future prospects.

They deal with the functioning of gas turbines, the fundamental principles of jet propulsion, and the performance, testing and maintenance of turbine units.

Combustion systems, fuel and control equipment and turbine design features are fully described and illustrated by specially-prepared sectional drawings.

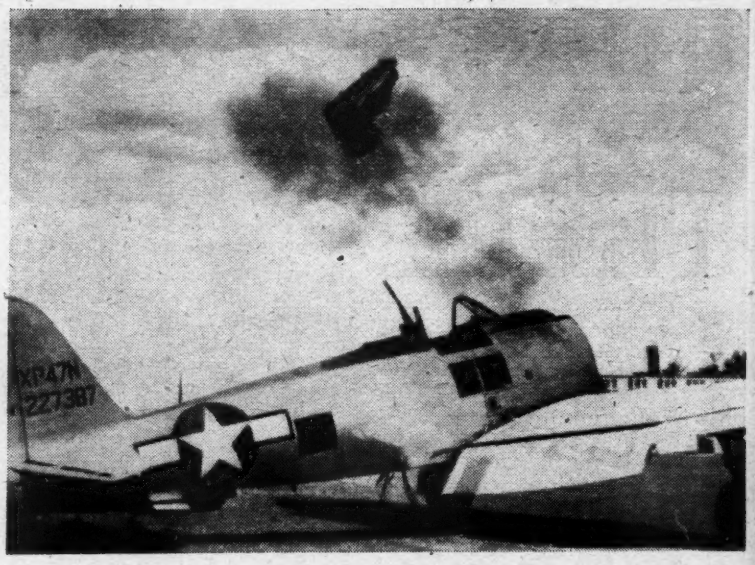
The relative merits of airscrew and jet propulsion under different operating conditions are assessed, and the influence of turbine power units on aircraft design is emphasized.

Special chapters outline the probable development of tailless and all-wing aircraft and discuss the problems of high speed flight, compressibility effects, and boundary layer control.

First published in 1942 when the significance of the gas turbine to the future progress of aviation was not generally appreciated, it was for long the only work on the subject. In subsequent years two further editions were published, but for some time these have been exhausted.

The work was widely adopted as the standard text on the subject by universities, technical institutions, and governmental and commercial training establishments. Two editions were also published in the U.S.A.

Copies of the fourth edition will be available in the course of a few weeks, price 12/6, from Flight Publishing Co. Ltd., Dorset House, Stamford St., London, S.E.1.



DUMMY EJECTION: The Americans are also, of course, experimenting with various methods of pilot-ejection to deal with modern fighter speed conditions. One is here being demonstrated, with a dummy pilot, at Dayton, Ohio.

News in Brief

THE Lancaster, *Thor*, arrived back at the Aircraft Armament Shool at Manby, Lincs., last week, at the end of its Empire mission to Australia and New Zealand.

* * *

Marshal of the R.A.F. Lord Tedder has been given permission to wear the Grand Cross of the Order of the Crown, with palm, and the Croix de Guerre, with palm, conferred on him by the Belgian Government.

* * *

Mr. J. J. Wickett had joined the Automotive Products, Co., Ltd., as general service manager of the associated companies, which include the Lockheed Hydraulic Brakes Co., and Borg and Beck, Ltd.

* * *

Aircraft are being used very extensively to bring fruit to England from the Continent. In fact, during a recent week every aircraft not otherwise in service, and including B.S.A.A. Lancastrians, were in use.

* * *

That old war horse, the Bristol Pegasus, is by no means at the end of its working life. Engines of this type will power two Supermarine Walrus amphibians which are to be used as whale-spotters in the Antarctic.

* * *

At the summer meeting of the Aero Golfing Society, held at St. George's Hill Golf Club on Tuesday, June 18th, the *Flight* Challenge Trophy was won by Group Capt. P. W. S. Bulman with a net return of 82. K. D. Morgan and W. A. Summers won the foursomes against bogey with a return of two up.

* * *

Professor W. J. Duncan has been appointed professor of aerodynamics, and Professor R. L. Lickey, professor of aircraft design, at the College of Aeronautics. The former was previously at the R.A.F., Farnborough, and the latter was chief project engineer of the Hawker Aircraft Co.

* * *

Established by the first Lord Inchcape in 1929, in memory of his daughter, who disappeared on an Atlantic flight, the Hon. Elsie Mackay Fund has more than doubled itself. The amount of the original gift was £527,808, and the value on March 31st this year was £1,334,793.

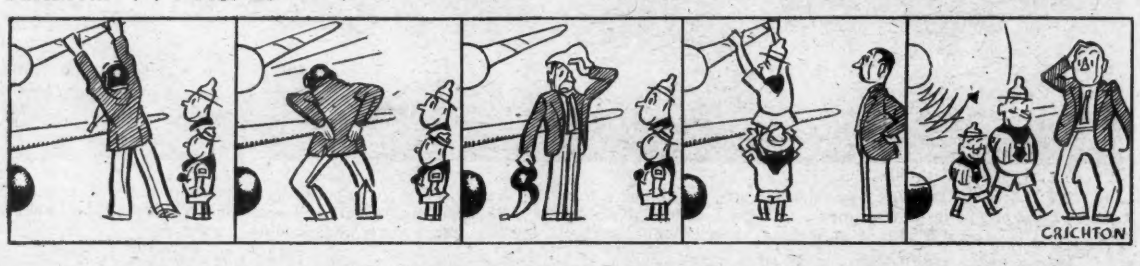
* * *

Dunlops claim that Group Capt. C. S. Morice, sales chief of their aviation division at Foleshill, Coventry, is the first flying commercial traveller. He is using a Proctor V.

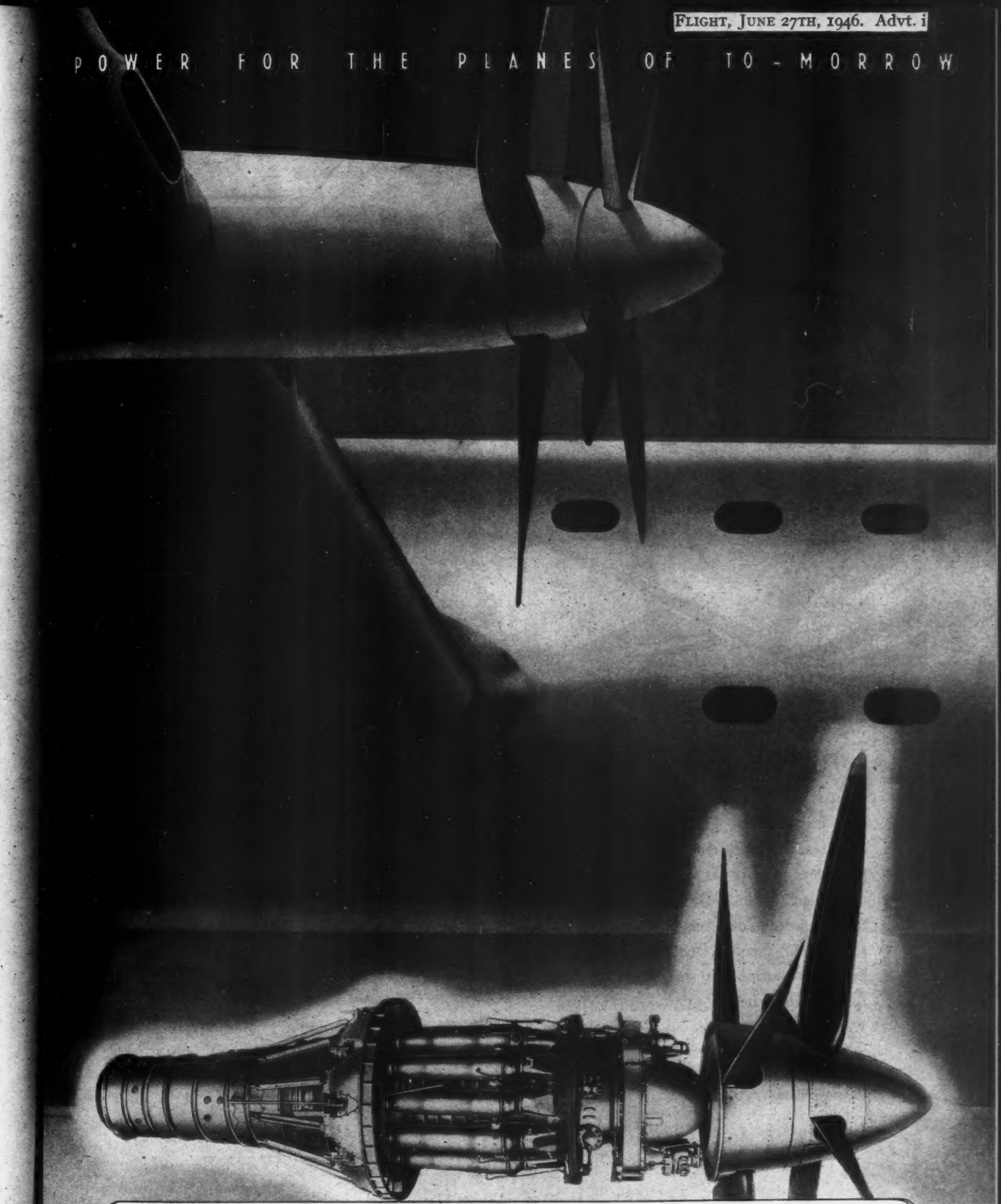
* * *

Modern Air Services, Ltd., are moving from Gatwick Airport on June 28 to White Waltham Airfield, Near Maidenhead, Berks.

AIRSTRIP . . . No. 20



POWER FOR THE PLANES OF TO-MORROW



ARMSTRONG SIDDELEY

PYTHON

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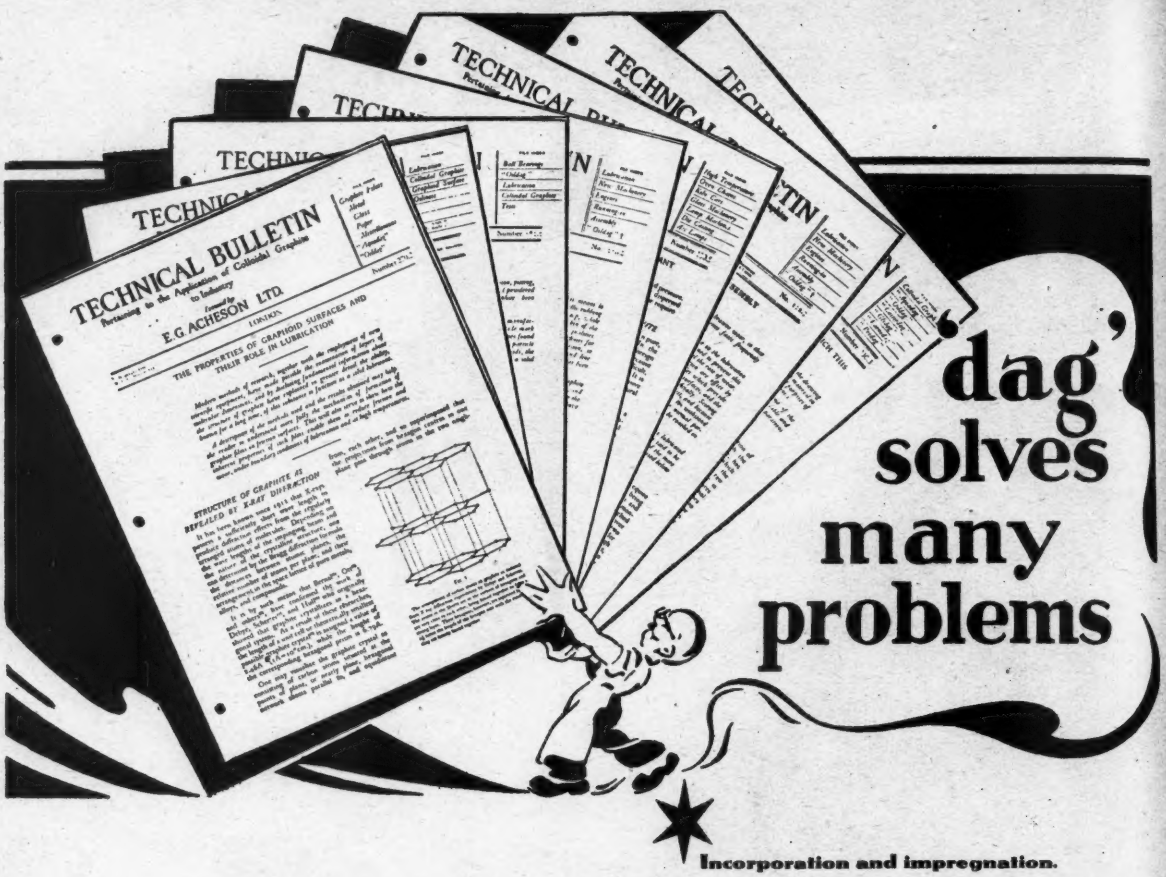
TECHNICAL BULLETIN
Pertaining to the Application of Colloidal Graphite to Industry
Issued by
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We suggest you invite our Technical Dept. to supply bulletins and other relevant data.

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Test Flying Training

The Work of the Royal Navy's Test Flying Squadron : Setting Recognized Standards

THE majority of people have heard of the Empire Test Pilots' School, now based at Cranfield, at which advanced theoretical and practical instruction is provided largely for the benefit of actual and prospective prototype test pilots. But not many people realize that, quite apart from the factory work on prototype and production aircraft, an enormous amount of flying is necessary month by month in the course of routine maintenance testing both of Service and other machines. Unfortunately, aircraft, by their very nature, tend to develop faults, and, particularly when wartime modifications of all kinds are continuously being made, they must be tested and re-tested if they are to become and to remain fully serviceable.

The need in the Navy for a really adequate and standardized test procedure is all the greater because, while the R.A.F. squadrons can bring up their own aircraft to a high state of efficiency, this is not possible when they have been delivered to an aircraft carrier. It is obviously impracticable for a carrier to swing out of line into wind in order to fly off aircraft for independent test flights. A Naval aircraft must be absolutely ready for operational flying once it has been landed on.

Whereas, in the R.A.F., the test flying at the many Maintenance Units was carried out by pilots who "learnt as they flew" and who gained any necessary additional knowledge either from courses with engine and ancillary manufacturers or by attachment to the manufacturers' test-flying teams, the Navy formed its own school of maintenance test flying. This started its life at Worthy Down as a branch of the School of Naval Aircraft Maintenance, but, after very few weeks, blossomed out as Number 700 (Test Flying) Naval Air Squadron, with Lt. Cdr. L. Castlemain, R.N.V.R.—who is now, incidentally, commercial manager of Skyways, Ltd.—as commanding officer. In November, 1945, the Squadron moved from Worthy Down to Middle Wallop and, when this Station was taken over by the R.A.F., moved to Yeovilton, where it is now commanded by Commander (E) (P) P. Illingworth, R.N.

The original test-flying course lasted only a month, and, in the thirty days, with the mornings occupied with lectures and the afternoons and evenings with flying, some very hard work was necessary if all the items on the curriculum were to be dealt with thoroughly. During the month a minimum of ten hours' flying, on nine basic types, had to be carried out, and lectures, covering all manner of subjects from basic airframe and engine design and handling to electrical, ignition and hydraulic systems, duly attended. The length of the course has since been increased to ten weeks.

FIREFLY (GRIFFON II.).

1. Check latchpin indicator in wing NOT showing.
2. Check ground/flight switch set to FLIGHT and rear cockpit switches ON.
3. Generator switch, ON.
4. Check u/c lights.
5. Check flaps HOUSED.
6. Fuel MAIN. 3-position fuel cock which also switches on immersed fuel boosters in each tank. Check fuel pressure warning lights on dash, OUT.
7. Throttle ½".
8. Mixture RICH.
9. C/S control, FORWARD.
10. Supercharger, MOD.
11. Carb. air COLD.
12. Prime 2½ times.
13. Fire starter cartridge and operate primer.

TAKE-OFF T—all O.
M—RICH.
P—C/S control FORWARD
Fuel, MAIN TANK
Flaps, TAKE-OFF
Supercharger, MOD
Carb. air COLD

Climb @ 135 k. Stall, 76/64 k.
Tanks, main 145 galls, 23 galls in each wing
Consumption @ weak cruise (175 k.), 60 g.p.h.
Rated altitudes—
Max. r.a.s.—

APPROACH Reduce to 175 k. Flaps CRUISE.
U—DOWN (155 k.).
M—RICH.
P—C/S control FORWARD.
Flaps, LANDING.
Supercharger, MOD.
Carb. air, COLD. Final approach, 85 k.

UNDERCARRIAGE. Normal, hydraulic.
Reserve, hydraulic accumulator.
Emergency, hand pump, squeeze handgrip at top of handle and pump.

FLAPS. Normal, hydraulic, 4-position lever.
Reserve, hydraulic accumulator.
Emergency, handpump, squeeze handgrip and pump.

Limits.	*Boost*	*R.p.m.*	*CHT*	*OT*	*OP*
Take-off					
Climb M. & S.					
Cruise rich M. & S.					
Cruise weak M. & S.					
All-Out M. & S.					

(Maintenance Test Flying Course, Worthy Down, January, 1945.)

An example of the "memory joggers" used by the Naval Test Flying Squadron, with ground, take-off, flight and approach checks.

Work Involved in Testing

The pilot who has not had experience of test flying, even of aircraft which might reasonably be expected to be serviceable, may not realize the amount of checking necessary in the mere twenty minutes or so of a routine test. The mental effort involved becomes much greater when very different types are being handled hour by hour. For instance, the relation between aileron shroud gap and lateral handling may vary greatly with different aircraft, and the methods of curing lateral trim faults may be equally divergent in principle. Again, one aircraft might not normally be expected to give maximum revolutions when being run up because, with the particular c.s. airscrew in use, the blades may be against the fine-pitch stops, while another aircraft would give full constant-speeding revolutions in all conditions. Apart from the need for detailed knowledge of the characteristics, operation and design features of each separate aircraft, the test pilot must also have thorough general understanding of whys and wherefores which can be applied to all types equally, and be of use when something new is being handled. Number 700 Squadron, in the course of its life, produced a set of lecture notes which formed, in themselves, almost a textbook on test flying.

The underlying idea of the Naval maintenance test-flying course was to take the pilot who had completed some operational time with an "above average" flying assessment, teach him something about the principles of the various installations and systems which make up the modern aircraft, and so to make it possible for him to diagnose defects in the air. An Admiralty Fleet Order was, in fact, "promulgated" to set out the functions of the maintenance test pilot; it was explained that he should be regarded as a specialized consultant to be called in by an Air Engineer Officer of a Station or ship, by the Superintendent of a Naval Aircraft Repair Yard, or by the C.O.

(*Concluded on page* 648.)

D

CLUB COMPENDIUM

Eighteen Clubs Now in Active Operation : More in Process of Formation : Average Flying Charges £3 to £4

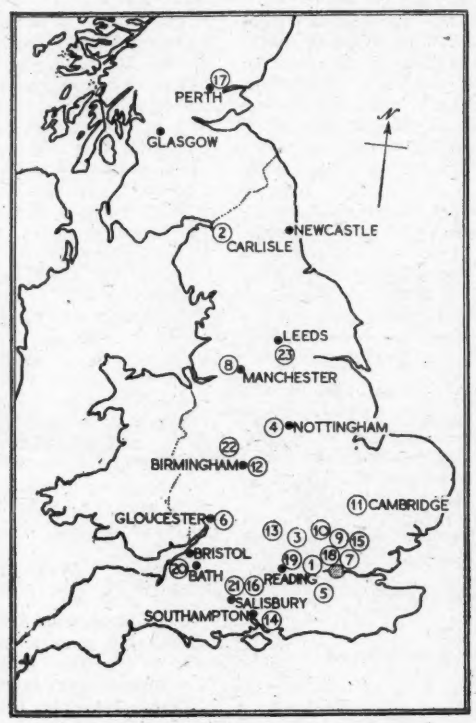
IN spite of the refusal of the Air Ministry, and/or of the Treasury, to offer a subsidy for club training, things are very far from being as black as the prophecies of the jeremiahs suggested or even as black as the realists feared. Many of us who had known the clubs and club way of life in pre-war days suspected that, when the prop of subsidy had been withdrawn, the entire movement would disappear with the exception, perhaps, of a few lightly supported centres for the benefit of comparatively wealthy flying enthusiasts.

At the time we suggested that, since the Government had obviously made up its mind quite firmly in the matter, a policy of drastic retrenchment would be essential. That, in fact, the stronger clubs would need to take the risk of reducing their flying rates to an absolute minimum in order to encourage large-scale support, even at the possibility of heavy losses for the time being.

Something of the kind appears to have happened, and after a comparatively brief period, during which the initially reformed clubs felt constrained to charge quite high rates, there has been a steady drop in the charges. Among the eighteen clubs now in active operation, the rates have, too, already reached a fairly standard level. There is, also, a useful tendency to standardize the charges for all types of aircraft, and to make these the same both for dual instruction and solo flying. This is a very good thing, inasmuch as it encourages inexperienced club pilots to take as much instruction as is possible or necessary; in the old days, the often considerable difference between the two flying rates tended to make those who had passed the first fence somewhat shy of any continuation of necessary advanced instruction.

Naturally enough, very many of the reconstituted clubs are suffering from various forms of "housing difficulty," though a few have managed to return to their original quarters, which have somehow avoided partial destruction at the hands of Service personnel and others. Some have obtained aircraft and are ready to operate, but have not so far been permitted to return to their original airfield centres, while others are unable to find such a centre, since their pre-war airfields may have been permanently taken over for other purposes.

It was difficult to know quite where to draw the line in a table of information such as this. The question, briefly, was "When is a club not a club?" The line has, in fact, been drawn between those clubs with an airfield, or the definite promise of one, and those which have not been quite so fortunate. Some of the clubs listed in the table are not yet flying, but these have, at least, an airfield base for their present and future operations.



To assist those interested the club positions are marked on this map—the numbers tallying with those on the right side of the table below.

TABULATED ADDRESSES, CHARGES and GENERAL INFORMATION

Club	Address	Tel. No.	Aircraft Used	Flying Charges (per hour) Solo	Flying Charges (per hour) Dual	En-tr'ce Fee	Subs.	Accom-modation	Airfield "Status"	Remarks	Map Ref. No.
				£ s.	£ s.	£ s.	£ s.				
Airwork Flying Club, Ltd.	134, Bath Road Hounslow, Middx.	Hounslow 5451	Tiger Moths	—	—	—	—	—	—	Flying should start before August from Denham airfield, Bucks. Club not yet active.	1
Border Flying Club, Ltd.	3, Citadel Row Carlisle	—	2 Tiger Moths 1 Magister	—	—	—	—	—	—	Future base—Kingstown airport, Carlisle—still requisitioned. Flying should start before August. Club not yet active.	2
Bucks & North London Flying Club.	c/o CTF Aviation, Ltd., Bishopstone, Aylesbury, Bucks.	Stone 286	—	—	—	—	—	—	—	Airfield at Haddenham, Nr. Aylesbury (Thame) still requisitioned. Club not yet active.	3
Derby Aero Club, Ltd.	Derby Airport Burnaston.	Etwall 123	1 Miles Monarch 1 Auster 3 Magisters	4 0	4 0	Nil	5 5	Lounge, bar and dining room.	Civil (unrestricted)	£3 10s. an hour dual and solo for contract flying (£100).	4
Fair Oaks Aero Club	Fair Oaks Aerodrome Chobham, Surrey.	Chobham 288	1 Auster 1 Tiger Moth 1 Gipsy Moth	3 0	4 0	1 1	3 3	Clubhouse shortly available.	R.A.F.	—	5
Gloucester Flying Club.	12, Arthur St. Gloucester	—	—	—	—	10	—	—	—	Ground instruction at Staverton Airfield, Gloucester.	6

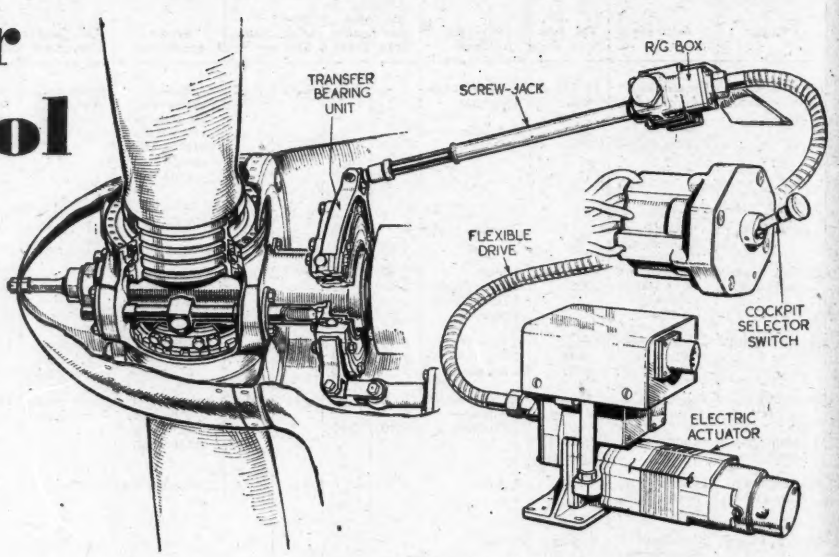
Club	Address	Tel. No.	Aircraft Used	Flying Charges (per hour) Solo	Flying Charges (per hour) Dual	En-tr'ce Fee	Subs.	Accom-modation	Airfield "Status"	Remarks	Map Ref. No.
				£ s.	£ s.	£ s.	£ s.				
Herts & Essex Aero Club, Ltd.	Broxbourne Aerodrome, Nazeing, Waltham Cross, Herts.	Hoddesdon 2453-2421-3180	2 Tiger Moths 1 Hornet Moth 1 Auster	3 0	3 5	2 2	3 3	Clubhouse, restaurant, billiards, bar, seven bedrooms. Hangarage and maintenance for private aircraft.	Private civil (unrestricted)	Monthly membership: £1 1s. Trial flying lesson 30s.	7
Lancashire Aero Club.	23, Deanway, Wilmslow, Manchester (temporary)	—	3 Austers (end of July)	3 0	3 0	2 2	5 5	—	—	Flying will be from Barton, Manchester, when de-requisitioned.	8
London Aeroplane Club.	c/o Royal Air Force Station Panshanger, Hertford.	Essendon 305	4 Hornet Moths 4 Tiger Moths 1 Auster	3 10	3 10	3 3	3 3	Restaurant, bar, lounge and offices.	R.A.F.	—	9
Luton Flying Club.	Luton Airport, Beds.	Luton 4426-4429	4 Tiger Moths 2 Proctors 1 Auster	3 10 6 0 3 0	3 10 6 0 3 0	Nil	2 2	Clubhouse	Municipal civil (unrestricted)	Lower rates for week-day flying. Monthly flying sub.: 10s. 6d. Link trainer available at 10s. an hour.	10
Marshall's Flying School, Ltd., and Cambridge Aero Club.	The Aerodrome, Newmarket Road, Cambridge.	Cambridge 5629 (ext. 3)	5 Tiger Moths 2 Austers 2 Proctors	3 0 6 10	3 0 6 10	Nil	Nil	Rest quarters—otherwise hotel by arrangement.	Civil (unrestricted)	Night flying training available.	11
Midland Aero Club, Ltd.	Elmdon Airport, Birmingham 26	—	3 Austers	3 0	3 0	Nil	4 4	Clubroom and bar	Unspecified	Country Membership: £1 1s.	12
Oxford Flying Club	Kidlington Aerodrome, Oxford.	Kidlington 201	1 Gipsy II Moth 1 Tiger Moth (Tiger Moth & Auster later)	3 0	4 0	1 1	Nil	—	Restricted	—	13
Portsmouth Aero Club.	Brunswick House, Bedhampton, Hants.	—	2 Tiger Moths 1 Magister	—	—	—	—	Clubhouse unrequisitioned	Unspecified	Awaiting return to Portsmouth airfield.	14
Royal Air Force Flying Club.	Panshanger Airfield Hertford, Herts.	Essendon 301	2 Austers 2 Moth Minors	2 0	—	2 0	5 0	Use of London Aeroplane Club's premises.	R.A.F.	Full membership confined to past and present officers of R.A.F., R.N., Army, their Reserves and Dominion Air Forces. Associate membership (with flying) for non-commissioned officers.	15
Royal Artillery Aero Club	c/o Wiltshire School of Flying, High Post Aerodrome, Salisbury, Wilts.	Middle Woodford 57	2 Auster Is.	2 10	2 10	Nil	2 2	Nil	Unspecified	Membership restricted to officers or ex-officers of all branches of the Royal Artillery.	16
Strathtay Aero Club, Ltd.	1, Charlotte St., Perth, and Perth Aerodrome, Scone.	Perth 349 Scone 295	1 Tiger Moth (another by September)	2 15	3 15	2 2	4 4	Clubrooms and restaurant.	Civil (unrestricted)	—	17
United Services Flying Club, Ltd.	Elstrae Aerodrome, Elstree, Herts.	Elstree 1677	5 Austers	4 0	4 0	1 0	5 0	Clubroom restaurant and bar	Unspecified	Past and present members of all British and allied military Services eligible.	18
West London Aero Club.	White Waltham Airfield, Nr. Maidenhead, Berks.	Littlewick Green 251	Hornet Moths, Moth Minors and Austers	3 10	3 10	Nil	5 5	Club premises and A.T.A. mess facilities.	Civil (unrestricted)	—	19
Weston Aero Club, Ltd.	The Airport, Weston-super-Mare	Weston 2700	1 Hornet Moth 1 Magister	3 0	3 0	Nil	Nil	Nil	Unspecified	No entrance fee or subscription charged pending provision of clubhouse.	20
Wiltshire Flying Club.	High Post Aerodrome, Salisbury, Wilts	Middle Woodford 57	5 Austers	3 0	3 0	Nil	3 3	Nil	Do.	—	21
Wolverhampton Aero Club	Municipal Aerodrome, Wolverhampton	Fordhouses 2191-2192	1 Auster 2 Magisters	3 10	3 10	Nil	4 4	Clubhouse	Do.	—	22
Yorkshire Aeroplane Club.	Lennerton Lodge, Sherburn-in-Elmet Aerodrome, Yorks.	South Milford 317	3 Austers	3 10	4 10	1 1	5 5	Clubhouse and restaurant, Langarage.	Do.	—	23

IN addition to the clubs in the table—which are those with a definite promise or hope of airfield accommodation—a number of others are known to be in embryo existence. The Scottish Flying Club, for instance—the address of whose chairman is 144, St. Vincent Street, Glasgow, C.2—has received indirect permission to operate from Renfrew, but there is neither hangar nor workshop accommodation available. Throughout the war the club has retained its foothold at Renfrew, retaining part of the club building for the benefit of "residents" and visitors. The Bristol and Wessex Aeroplane Club, Ltd., of Bristol Airport, Whitchurch, Bristol (Bristol 26451-Ex. 8) have three Austers in process of reconditioning, but have no definite permission, as yet, for operations from Whitchurch. Among other clubs not tabulated, but for whom we have addresses and which appear to be in process of re-formation, are :—The South Coast Flying Club, The Aerodrome, Shoreham, Sussex; the Bournemouth Flying Club, Bourne Chambers, St. Peter's Road, Bournemouth; The Cardiff Aeroplane Club, Ltd., c/o C. H. Bailey, Ltd. East Dock, Cardiff; The Redhill Flying Club, Staplehurst Farm, Salfords, Surrey; The South Downs Aero Club, c/o W. A. Rollason, Terminal House, Grosvenor Gardens, S.W.1; The Liverpool and District Aero Club, 252, Greenhill Road, Mossley Hill, Liverpool, 18; and the Cinque Ports Flying Club, Berwick House, Lympne, Kent.

One of those for which information was received too late for inclusion in the table is the Auster Flying Club. This, in any case, hardly comes into the true club category since membership is restricted to employees of Auster Aircraft. It operates from Rearsby, near Leicester, using four Auster Is, and, as a matter of interest, the hourly rate for both dual and solo flying is as low as £1. Another is the Hampshire Aeroplane Club, which will soon be restarting at Eastleigh, Southampton.

Junior Rotol

A Small, Light, Two-bladed, Controllable-Pitch, Feathering Airscrew for Light Aircraft

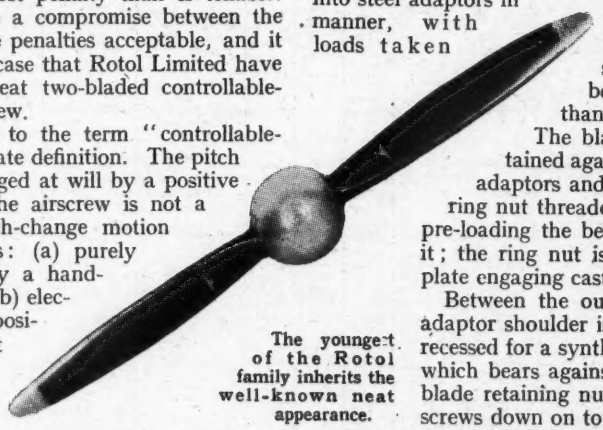


The detail design and operational motion from actuator, via screw-jack and transfer unit to the blades can readily be followed in this *Flight* sketch.

ALTHOUGH there have been arguments among flying people and aeronautical engineers as to the necessities for and merits of variable-pitch airscrews for the lighter categories of aircraft, quite obviously a variable-pitch airscrew is going to give positive advantages to the aircraft on which it is fitted, irrespective of size, although the extent of the advantage is certainly a matter of degree, dependent upon the power range of the engine and the speed range of the aircraft.

However, a constant-speed airscrew suitable for engines of 80 to 150 h.p., although presenting no intrinsic mechanical difficulties, would undoubtedly incur a somewhat higher weight and cost penalty than is tenable. The alternative is to have a compromise between the advantages desired and the penalties acceptable, and it is in an effort to meet this case that Rotol Limited have produced this extremely neat two-bladed controllable-pitch and feathering airscrew.

Accent should be given to the term "controllable-pitch," for that is an accurate definition. The pitch of the blades may be changed at will by a positive mechanical linkage, but the airscrew is not a constant-speed type. Pitch-change motion is available in two guises: (a) purely manual, with actuation by a hand-crank in the cockpit; and (b) electric, by means of a three-position switch in the cockpit controlling a remotely mounted electric actuator which, in turn, provides the motive power for pitch change. It is thus unlikely that the manual actuation will be employed on anything but light single-engined aircraft types, whilst the electric actuation will probably be employed on the rather more expensive single-engined machines, and twin-engined aircraft on which advantage can be taken of the feathering quality.

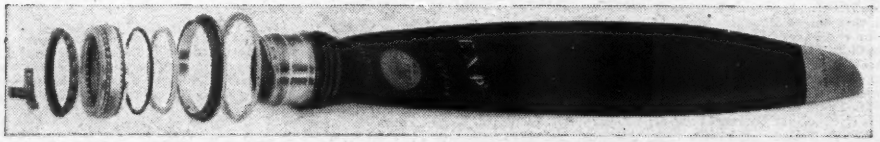


The youngest of the Rotol family inherits the well-known neat appearance.

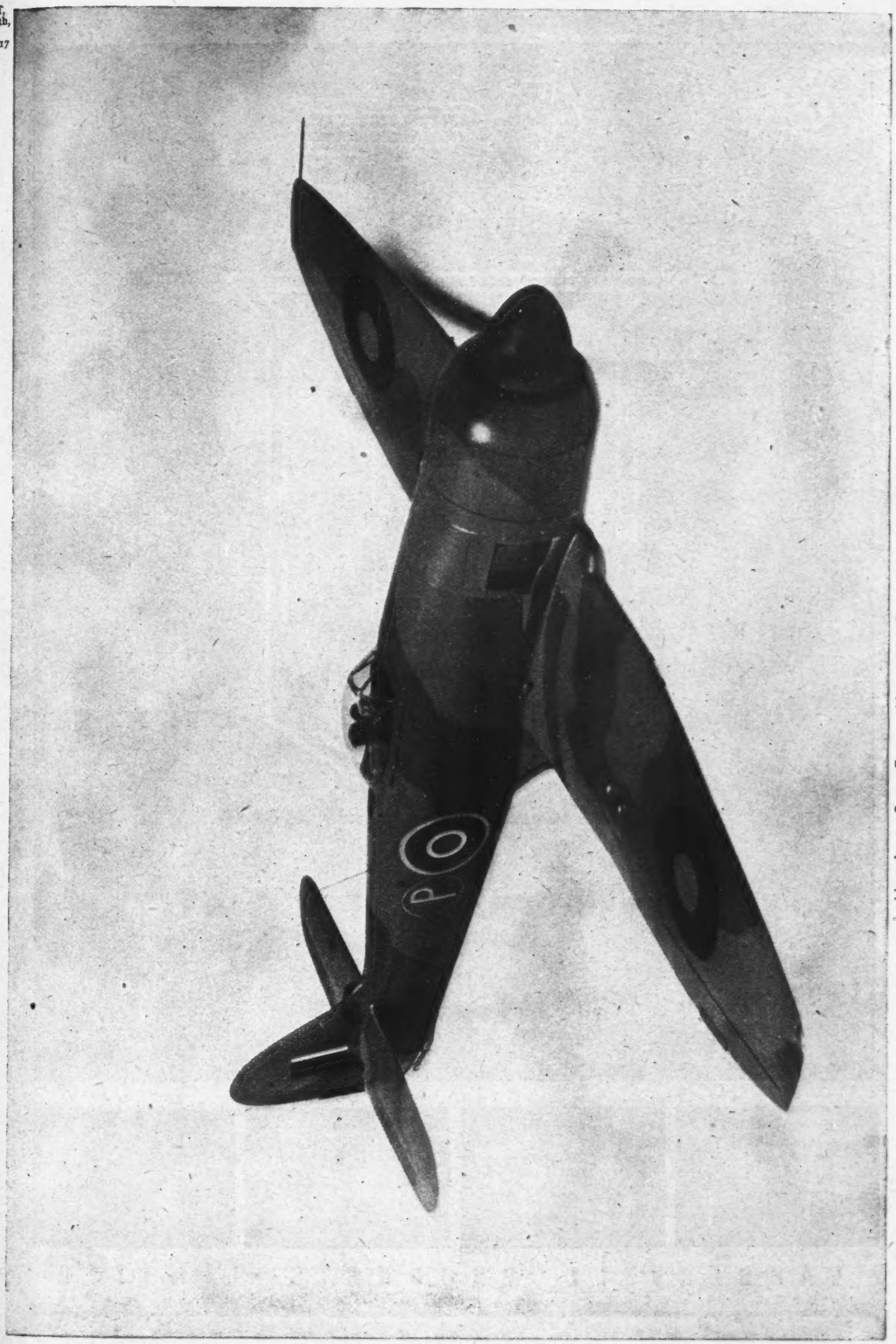
The hub is a light, single-piece unit with a rear extension tube having a tapered bore to fit a No. 0. S.B.A.C. tapered airscrew shaft, being locked by a key engaging keyways both in hub and shaft. The hub is retained by a tubular shaft nut engaging the airscrew shaft, with a steady bearing at its front end in the forward face of the hub shell, and is locked by a tab locking-ring secured with a circlip.

Blades are compressed wood by Jablo and are screwed into steel adaptors in the conventional Rotol manner, with rotary and centrifugal loads taken by two-row ball-bearing stacks, the inner-row balls being of larger diameter than those of the outer row. The blade bearing stacks are retained against shoulders on the blade adaptors and are kept in position by a ring nut threaded to the adaptor skirt, so pre-loading the bearing as well as confining it; the ring nut is locked by a tab washer plate engaging castellated slots on the nut.

Between the outer bearing race and the adaptor shoulder is an oil-seal retaining-ring recessed for a synthetic-rubber cup-type seal, which bears against the inner surface of the blade retaining nut. This latter component screws down on to the projecting centre race of the blade bearing and nips it against a buttress on the inside diameter of the blade barrel; the blade retaining nut is externally threaded for screwing into the blade barrels, and has eight 2BA studs on its top surface for securing the shim cover plate beneath which balancing shims are retained. The cover plate also acts as a lock for the retaining nut by having tabs



Blade assembly showing shim cover, retaining nut, oil seal, bearing stack, adaptor nut and operating pin.



Hawker Sea Fury (*Bristol Centaurus Engine*).

[Advt.

AND NOW

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STANDARDISE

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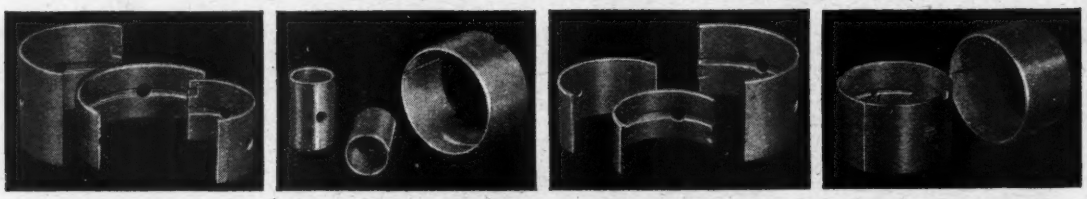
Thinwall Bearings

ON THE 4½-LITRE SILVER WRAITH



VANDERVELL PRODUCTS LIMITED

WESTERN AVENUE • PARK ROYAL • LONDON • W·3

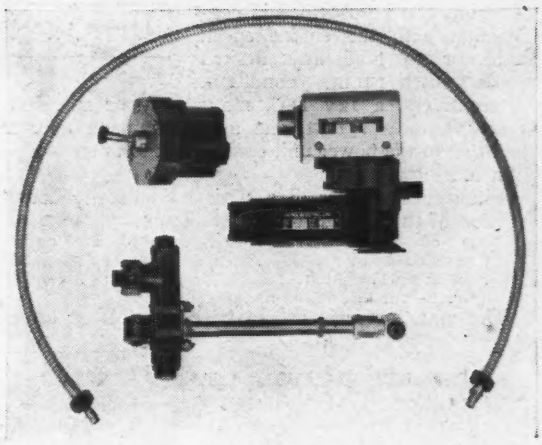
Smee's

JUNIOR ROTOL

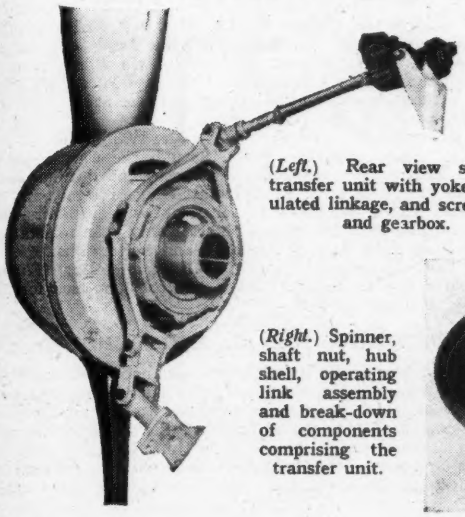
which extend down over the nut and engage slots machined in the perimeter of the blade barrel rim.

Very briefly, the pitch change motion is effected by offset pins on the blade roots to which operating links are pivoted. The operating links are given a linear motion by means of a transfer unit behind the hub, the result being to twist the blades in their bearings and so change the pitch.

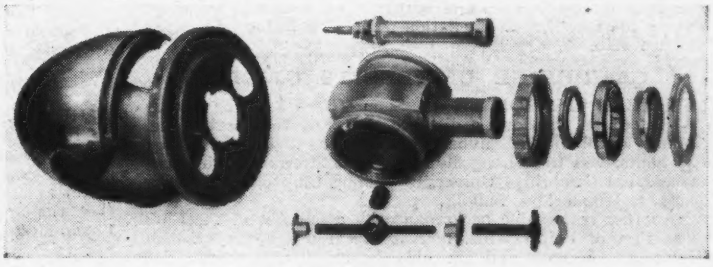
The operating pins are screwed to the base of the blade adaptor and engage Tufnol bushes on the operating links. These bushes are a sliding fit in their housings, the latter being slotted for passage of the operating pin engaging the bush so that compensation for linear movement of the links and radial movement of the pins is allowed. The forward ends of the links slide in phosphor bronze bushes bolted on the face of the hub shell, and the rear portion of the link engages a tubular sleeve fitting—to which it is bolted—this in turn being bolted to the inner (rotating) member of the transfer unit.



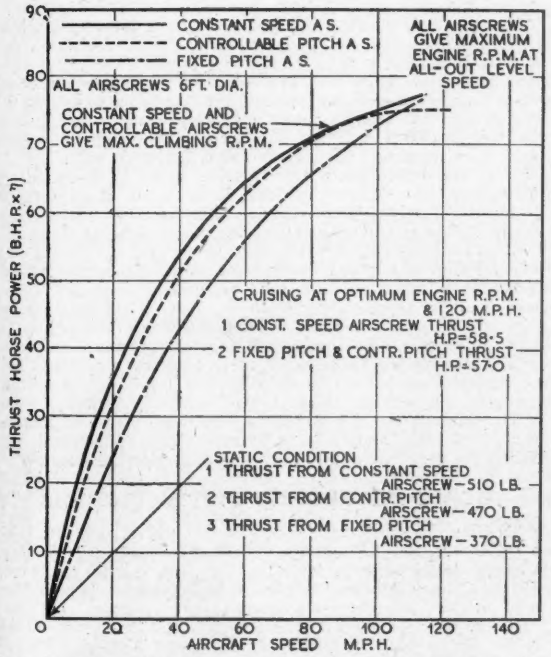
Flexible drive enclosing selector switch, e.ectric actuator unit, reduction gear and screw-jack.



(*Left.*) Rear view showing transfer unit with yoke, articulated linkage, and screw jack and gearbox.



(*Right.*) Spinner, shaft nut, hub shell, operating link assembly and break-down of components comprising the transfer unit.



Comparative performance curves of c.s., c.p. and f.p. airscrews, all of 6ft dia., and all designed for the same optimum condition.

The Transfer Unit

This transfer unit is essentially a single ball-race enclosed in a fabricated housing comprising outer and inner members, the former remaining stationary whilst the latter rotates with the airscrew. As described, the pitch change operating links are attached to the inner member, but the outer member is pivoted to a yoke which at one end is attached by an articulated linkage to the engine casing, and at the other end to a screw jack. The latter is driven through a miniature reduction gear box of 25 : 1 ratio, the input of which is derived from a flexible drive coupled, as the case may be, either to a 24V D.C. electric actuator mounted on the rear face of the engine firewall, or conversely, to a hand crank conveniently located in the cockpit. The hand crank has an integral 2 : 1 reduction gear, so that little effort is required by the pilot to change blade pitch, approximately five turns of the crank giving a pitch change of one deg. Additionally, an indicator is incorporated in the crank giving positive readings for "take-off and climb," "cruising" and "all out level flight."

For electric actuation the 3-position selector switch supplanting the hand crank in the cockpit operates in conjunction with limit switches in the actuator unit to give positive selections for obtaining "take-off and climb," "cruise and all out level" and "feather" blade conditions. Naturally, as with the hand crank, intermediate

JUNIOR ROTOL (CONT.)

positions can be obtained in conjunction with the engine speed indicator to give any desired blade pitch/r.p.m. condition. Alternatively, a 12V D.C. motor may be specified in place of the 24V unit, and a potentiometer may then be fitted to the power unit control box to operate a position indicator.

Pitch change rates of a typical electrically actuated version of this airscrew are as follows:—

Take-off to cruise	1 to 2 seconds
Cruise to feather	10 to 12 seconds
Feather to fine pitch (direct—not through cruise position)	12 to 14 seconds

The manufacturers are to be congratulated on producing so robust a unit for such light weight, for the bare airscrew, including spinner, weighs but 49 lb 9 oz, whilst the total installed weights are respectively 60 lb 8 oz for the electric type and 55 lb 4 oz for the manual type of airscrew.

Servicing periods are not as yet fixed, but on their past experience the manufacturers consider that the overhaul period for these units should be 1,000 hours at the very least; and, whilst it is difficult to provide a firm figure for cost, it is expected that this should be approximately £100 to £120 according to the method of actuation.

CONSTELLATION LOAD FACTORS

CONCERNING a leading article in our issue of May 9th dealing with load factors, Mr. Hall L. Hibbard, vice-president and chief engineer of the Lockheed Aircraft Corporation, points out that the Constellations are fully licensed for a load factor of 3.75 at 90,000 lb loaded weight and that there are no "waivers." In our issue of May 23rd we published a paragraph quoting Mr. T. R. Thomas, secretary of the Air Registration Board, in which he explained that the Constellations had been validated at a load factor of 3.75, and that in order to maintain this factor certain operating limitations were necessary in the distribution of fuel, but that these limitations were not likely to be restrictive to the operator.

Mr. Hibbard reminds us that 3.75 is the load factor used in America for many years and is that of all American transport flying to-day. The Constellation meets this factor fully in its loaded state

CAMBRIDGE UNIVERSITY GLIDING

PRINCE BIRABONGSE of Siam (B. Bira, the racing motorist) has flown a distance of 187 miles in a sailplane, taking with him his Sealyham mascot. The flight, which took 4½ hours, was from Long Mynd, Church Stretton, Shropshire, where the Cambridge University Gliding Club camp is being held, to Woodbridge, Suffolk.

Another remarkable performance by a member of the Club was that of Philip Wills, now technical manager of British European Airways and the only holder of the Gold "C" Badge. He broke the British height record with a figure of 15,300ft in the Weihe sailplane, which, without oxygen and knowing how long such a climb might take, was a very fine effort.

TEST-FLYING TRAINING

(*Concluded from page 643*)

of a squadron, to provide a specialized report on an aircraft and its equipment. It was also laid down that a copy of the test pilot's report should accompany the aircraft's Form 700 So the Naval test pilot's position was comfortably consolidated, and he was not left hanging vaguely between the C.O. and the engineer officer. An interesting feature of the Squadron's curriculum was the institution of visits by many of the chief test pilots and technicians from the various manufacturers of Naval aircraft. These pilots and technicians gave lectures and demonstrations covering their own particular subjects. Normally, on each course, the Squadron was visited by representatives from the majority of the manufacturers as well as by Naval experts in particular branches of aircraft development work. In addition, each course visited the Naval School of Aircraft Maintenance, the R.A.E. and various manufacturing firms.

Until now, the course has covered only the testing of single-engined Naval types—both American and British—but it is shortly to be equipped with Mosquitos, and all pilots now appointed to the Squadron will have previously undergone a twin conversion course. As a matter of interest, it might, perhaps, be explained why the words "test flying" appear in brackets. This was because the original 700 was the famous squadron which controlled aircraft operating by catapult from cruisers and other ships; this squadron was disbanded at the end of 1944.

BACK TO BETTER JOBS

HIGH tribute to Claude Wallis, M.B.E., chairman and managing director of Associated Iliffe Press, our parent company, was paid by Lord Camrose at the firm's reunion dinner at the Connaught Rooms on Thursday, June 20th. He testified without reserve to the courage and resolution possessed in a high degree by Mr. Wallis.

Over 500 members of the staff heard Mr. Wallis describe the progress of Associated Iliffe Press through the war, welcome back the returned Service men and women, and outline plans and policy for the future. From Dorset House 170 men and 30 women had joined the Forces; 70 had obtained commissions. Those returning from the Forces had not only been reinstated, but had come back to bigger salaries and better jobs.

Wing Cdr. Maurice A. Smith, D.F.C. and Bar (*Flight*) and Major S. C. H. (Sammy) Davis (*Autocar*), replied for the ex-Service men and women.

EXTENDING R.Ae.C. MEMBERSHIP

THE Committee of the Royal Aero Club announced last week that an Associate Membership scheme has been inaugurated, the object of which is to make available to the air traveller services comparable to those afforded the motorist by the motoring organizations. At the same time, it was announced that the Marquess of Londonderry has offered the loan of Londonderry House, Park Lane, for a number of years in connection with the new venture. Londonderry House is at present requisitioned by the Army, but as soon as it is free all sections of the R.Ae.C. excepting those of a purely social nature will move to Park Lane.

The new headquarters will house the more important organizations affiliated to the club, and here, also, consultation and advice covering a wide range of subjects will be possible. The new premises will also contain a collection of aeronautical books for reference purposes, and the new reading rooms will carry the majority of the world's aeronautical periodicals. In addition to these facilities, a cinema and lecture hall, conference hall, exhibition room and banqueting hall will also be included.

It is the intention of the R.Ae.C. to make Londonderry House the "Air Centre" of Great Britain, but, as adjuncts, it is hoped to establish other centres in the main provincial cities, which will be run in connection with the local flying clubs.

With the gradual if slow return to private ownership and club membership, the touring department, with its map section and available information, will tend to become more and more useful, and a special department has been established for the issue of Customs carnets and to assist in the obtainment of passports and visas. Further to aid the air traveller, uniformed representatives will be attached to all Customs airports in this country and abroad to organize Customs, local travel facilities, accommodation or anything else the member requires.

The subscription for Associate Membership is two guineas per annum and, in addition to the advantages enumerated, this covers the provision of free legal aid and personal insurance.

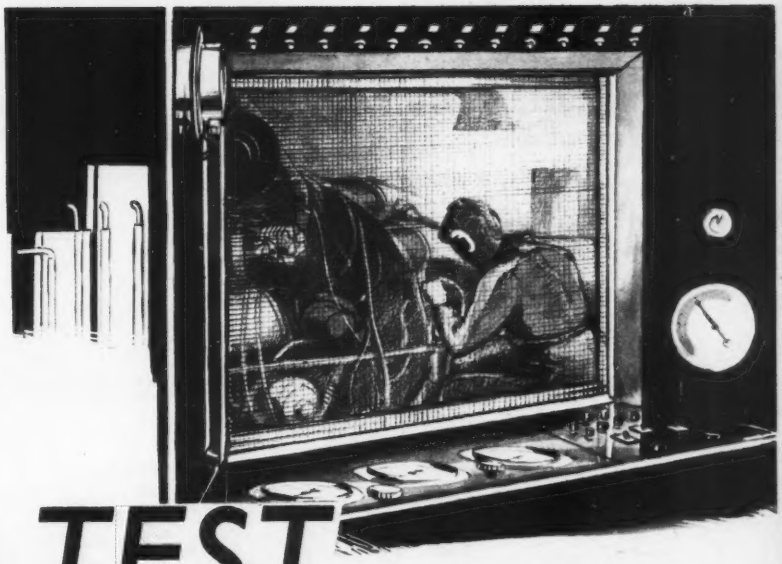
HOME SECRETARY VISITS VICKERS

ON Saturday, June 22nd, the Home Secretary, the Rt. Hon. Chuter Ede, J.P., M.P., visited the Weybridge works of Vickers Armstrongs, Ltd., and presented the prizes at the Surrey County Amateur Athletic Championships, which were held on the Vickers' Sports Ground.

Before the presentation he was entertained to lunch by Major H. R. Kilner, M.C., Director of the Aircraft Section of Vickers Armstrongs, Ltd., and taken for a short flight in the Vickers Viking.

Production Test Houses at Hatfield: Grouping of Like Instruments: Direct Thrust Measurement: D. H. Goblin Test Schedule

JETS on TEST



THROUGH THE LOOKING GLASS: A tester, with special ear protectors, searches a running Goblin for fuel leaks.

PRODUCTION-TESTING of plain jet power units does not present the same difficulty as the testing of high-powered piston engines, and the whole process of installation and thrust measurement can be accomplished in a comparatively simple and straightforward manner. The time required to instal a Goblin for test is only 2 hours, and removal from the bed takes no more than 1½ hours.

At least three different types of test houses are used by the de Havilland Company at Hatfield for their gas turbine engines. These include the early production beds, a later design and the experimental test houses. In each case the arrangements are similar, but the houses differ in detail and in type and quantity of instruments and equipment.

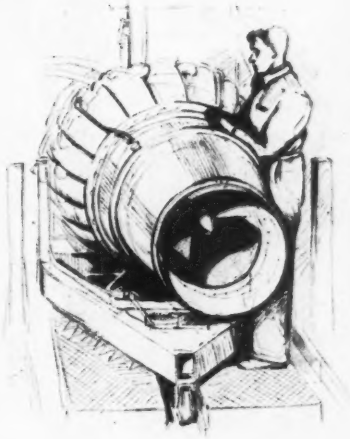
Each production test house is separate and self-contained and comprises basically the engine compartment, the control room and the exhaust tunnel, while in addition there are pump, filter, rectifier, tank and fan rooms.

A Goblin unit on its mobile stand is wheeled in through a door in the rear end of the exhaust tunnel, positioned on the floating test platform, which is supported on rollers, and secured with the aid of blocks in front and a turnbuckle coupling at the rear. A forked flexible air-intake duct is attached to the compressor intakes, pipe lines and controls are connected-up, and the exhaust detuner duct and tail pipe guard are brought into position.

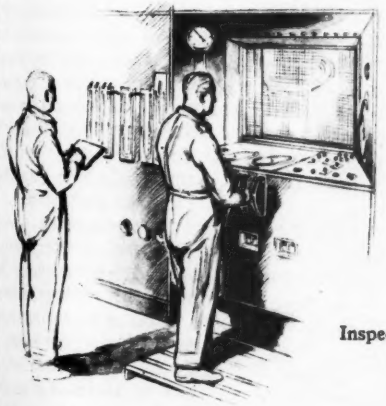
Thrust is measured directly through the reaction of the unit or mounting against a statimeter transmitter button. The movement is very small, and the button on production beds is connected by capilliary tubing to a Burdon Gauge registering in pounds thrust. A plate for contact with the button is now provided on the intake casing of the power unit; previously this was placed on the engine cradle. In connection with thrust measurement, a very simple dead-weight direct-calibrating device has been installed. The system is diagrammatically illustrated on page d. On the most modern beds, just completed, Goblins are secured to a floating platform connected by a system of levers to a large Vandome and Hart weighing machine from which a direct thrust-reading in pounds is obtained. The dial is very large and carries two scales. A capacity-change lever selects the loading for the Zero to 3,500 lb. or the Zero to 6,000 lb. scale.

When the unit is running, temperatures, pressures and consumptions are observed and recorded in a sound-proofed control-room in the same way as for any other type of engine. The particular system of stroboscopic

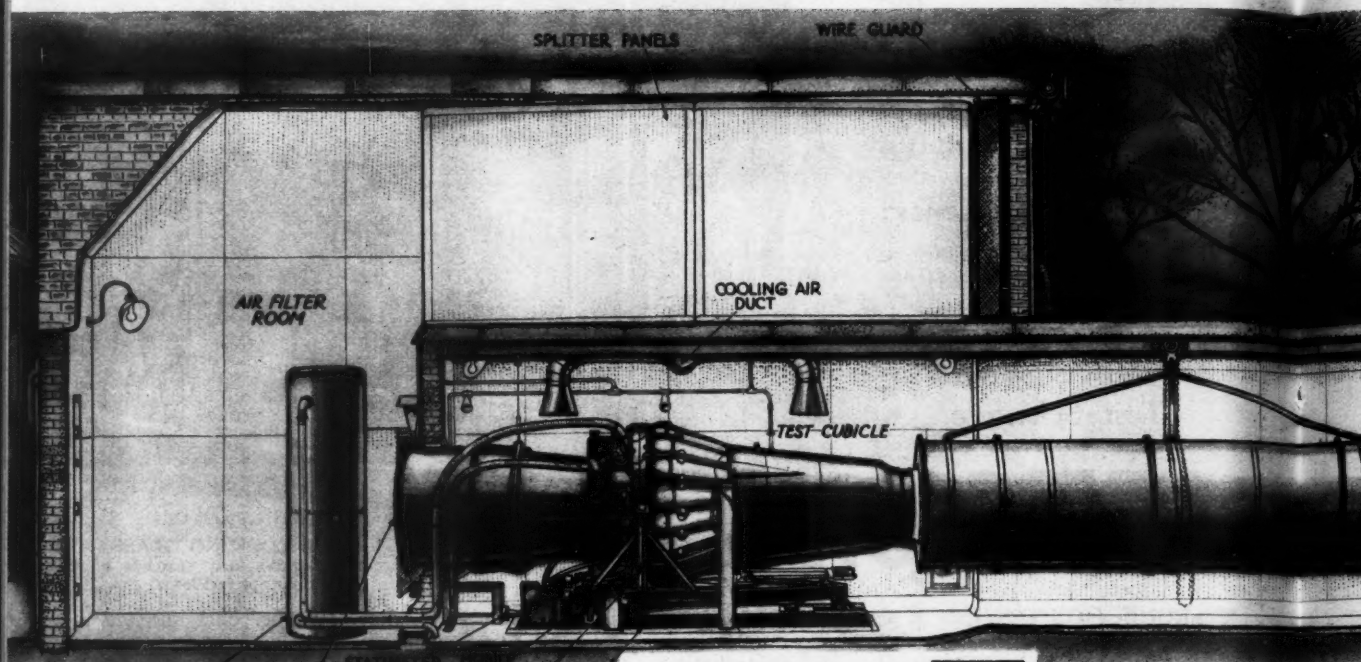
THE changes in requirements for production engine testing during the last two decades gives an interesting indication of aero engine development. In the first place, little more was expected than that the engine should keep running for a given period, and satisfy certain power and consumption limitations. Later, with the wider use of supercharging, it became necessary to simulate the low atmospheric pressure of high altitudes. In the testing of a pure jet unit such as the Goblin, thrust measurement is comparatively simple, but the recording of temperatures and pressures at many points throughout the power unit gives a clue to the close limits and precise running conditions which are characteristic of the modern engine.

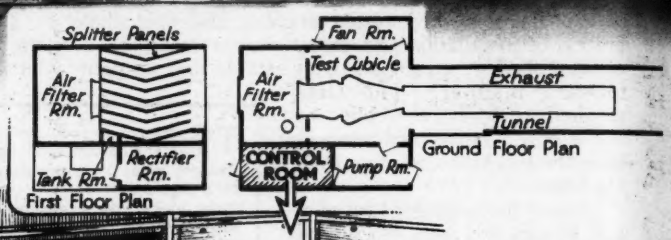


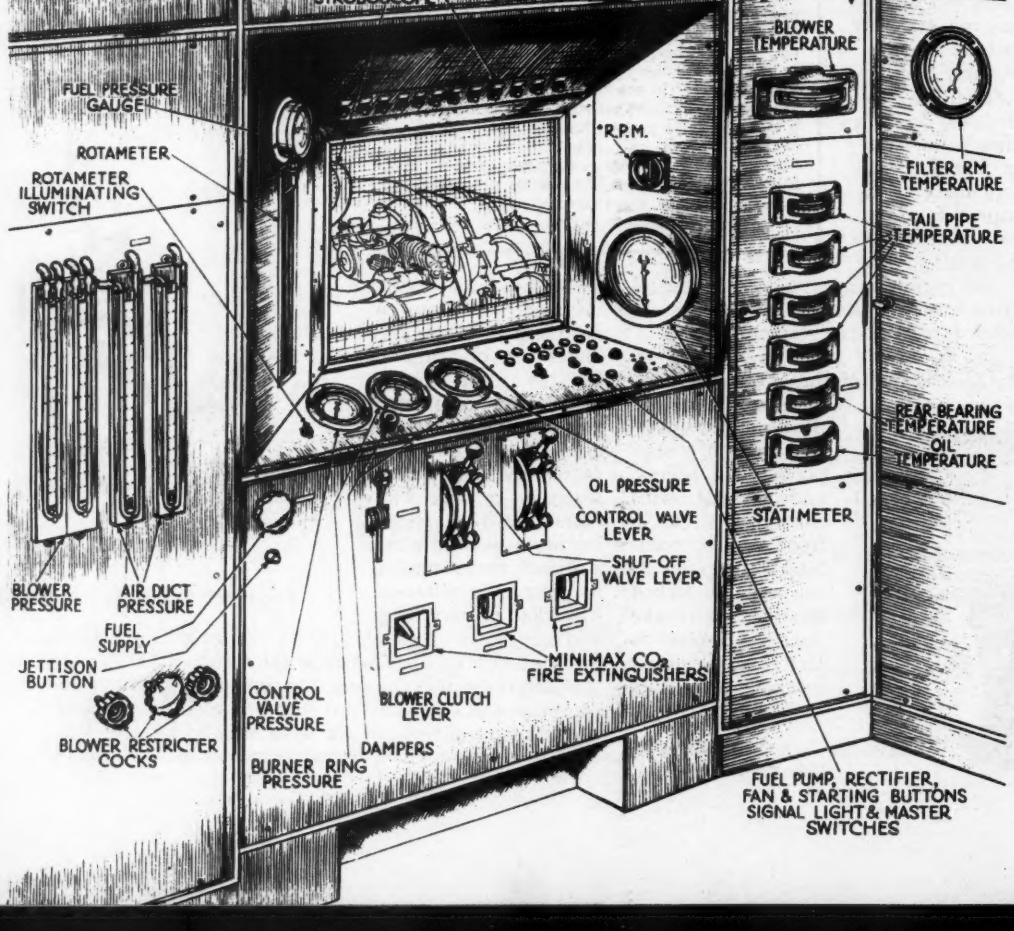
Preparing a Goblin for test running.



Inspector and head tester at their stations.







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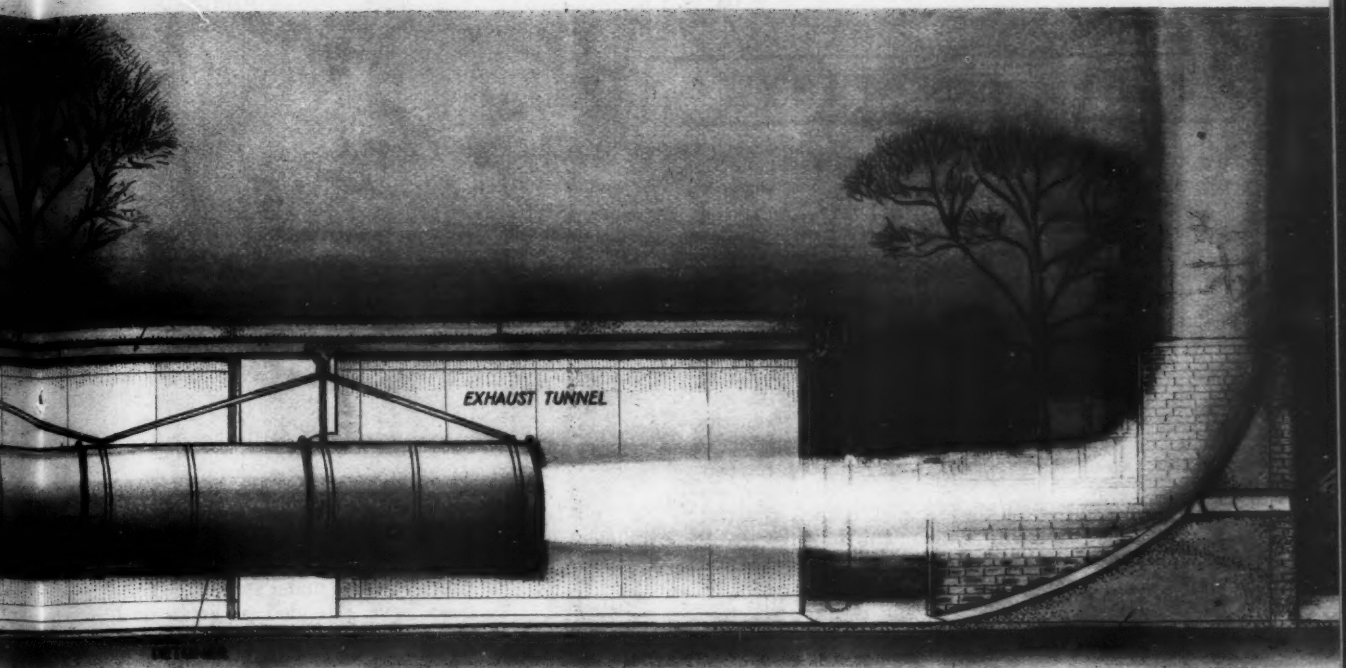


A SECTION through one of the production test houses built at Hatfield for de Havilland jet units. The Goblin gas turbine is moved into position on a mobile cradle, entrance being gained through a door at the near side of the building next to the pump room. It will be seen that the detuner is supported on a monorail so that it may be moved away towards the blast-deflecting wall while the engine is installed. The Marshal blower tank takes the place of the aircraft cockpit for pressurisation tests. The air ducts for conditioning the atmosphere of the engine test cubicle, and the fixed fire extinguisher system are clearly shown. (Lower left) The control panel and inspection window are shown in detail together with some of the instruments. (Below) The readings required during test and the points from which they are taken are illustrated diagrammatically.

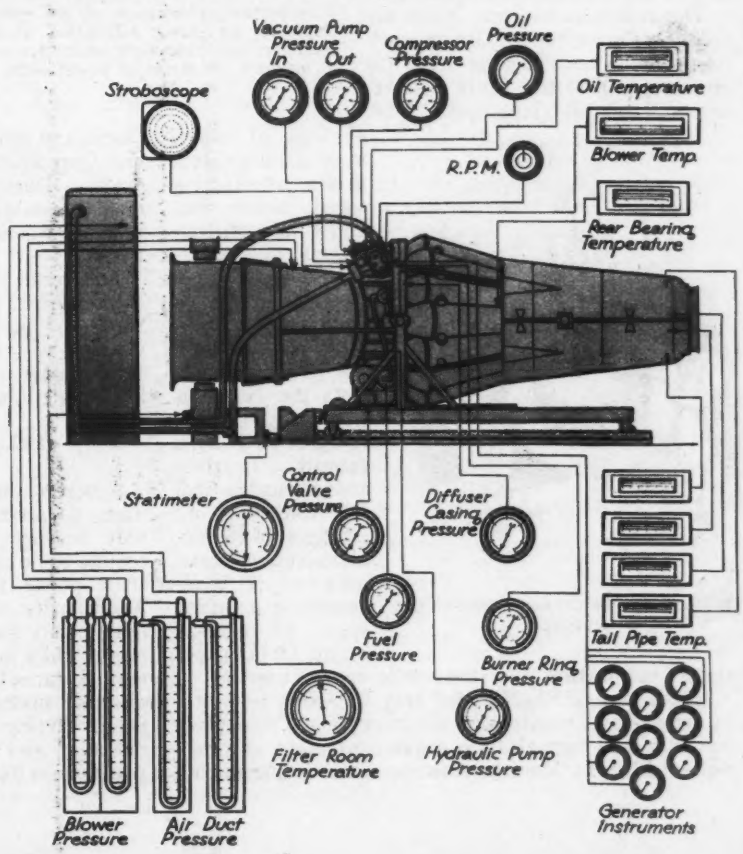
easurement on some beds is interesting and a little out The set-up is the work of the de Havilland company, d are a master tuning fork with electrically-controlled three-aperture scanning disc, both in the engine com- r.p.m. are indicated electrically in the control cabin and c is observed through the double window to the engine When testing any power unit, the requirement is usually ermined engine speeds (as opposed to measuring r.p.m., given throttle settings or combustion temperatures.) The anning disc gives accurate readings through its three ousands, hundreds and fractions of one hundred r.p.m.

Grouping of Instruments

iment panel, temperature gauges are arranged to the re gauges to the left. The fuel flow meter, on the left of known as a Rotameter and registers in lb. per hour. The supply is pumped electrically from tanks under ground. nnected with electrical equipment are also grouped he main units are placed in the rectifier room above the These comprise the rectifier for use with the jet unit's tor instead of ground accumulators; resistances for the , and all fuses. Below, there is an A.C.-D.C. universal panel and the voltage meter for the variable output can be used to simulate starting-up with partially-dis- es.

s observed include those of the air-intake duct, com- , combustion chambers, jet pipe (at four points), rear mp, Heywood compressor, and for instrument correc- l cabin and filter room temperatures.

pressures measured are those for intake duct, impeller rbine, tail pipe and vacuum pump. The main hydraulic d in conjunction with a loading valve up to 3,000 lb. the Marshall blower for pressure cockpit or cabin has a tank in the filter room.



JETS ON TEST

An air pressure and extractor system is one of the permanent installations in the test houses. Its purpose is the extraction of fumes as required between runs, but more particularly the supply of air to make up for losses due to the considerable venturi effect of the jet and detuner (exhaust extension).

Foam Extinguishers

Provision against fire risks is made with a number of large Minimax foam-producing extinguishers with gallery pipes and jets at appropriate points throughout the building. They would usually be hand-operated, but automatic capsules are also provided in the rectifier room.

With the exception of the exhaust tunnel, the test houses are very compact. Intake air is conveniently drawn-in through a large duct over the test cubicle and passes through "splitter" panels before entering the filter room. Since the engines must often put up with non-filtered air when installed in an aircraft, they are expected to do so on test. The name filter room is something of a misnomer for what may be seen in the drawing to be a large intermediate compartment in the intake-air duct system.

At the end of the exhaust tunnel a brick blast wall is provided to deflect the jet vertically upwards.

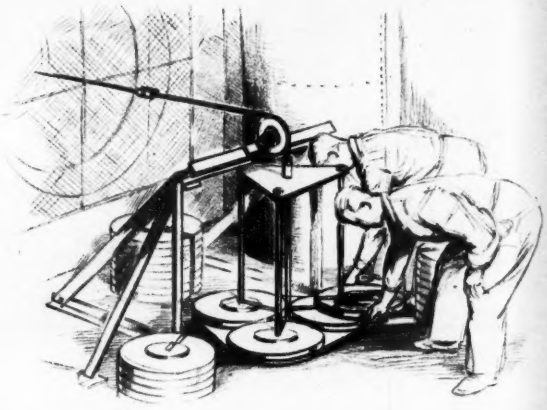
The test schedule laid down for Goblins is as follows: (1) Preliminary adjustments and starting test. (2) Non-stop run of two hours, consisting of 5 min. at idling speed, 1 hr. 45 min. at maximum cruising speed, 5 min. at climbing speed, and 5 min. under take-off conditions. (3) Acceleration tests from idling speed to maximum r.p.m.

On completion of the preliminary tests the engine is stripped-down, inspected and rebuilt. It then goes through a final test consisting of: (1) A run of 15 min. at maximum cruising speed. (2) Accelerations from idling speed to take-off r.p.m. (3) Complete thrust calibration over the whole speed range.

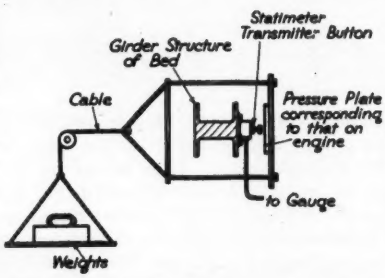
In the issue of *Flight*, dated May 2, Goblin tests of a rather different nature were described. These took place in the special high-altitude engine test plant at Oberweisenfeld, near Munich, Austria. This unique testing equipment was first mentioned in *Flight* of September 27, 1945, following examination by the Managing Editor. Tests under extreme conditions have provided a great deal of valuable information concerning jet units, and although in this country there are a large number of first-class production and experimental test beds, the need for special equipment capable of simulating all flight conditions has for some time been felt by manufacturers of gas turbine units.

Moving parts and individual units, pumps, compressors, etc., of piston engines are all first tested prior to assembly on the engine proper, and this practice is also common in the case of gas turbines. In the first instance, turbine discs with their blades and compressor impellers are balanced separately and then again as a unit when bolted-up on the main shaft. During development these two components may be subjected to overspeed tests in a special building where disintegration, if it occurs, can do no harm.

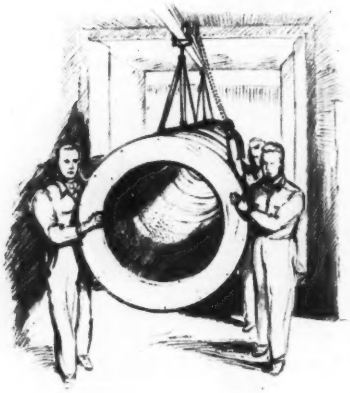
As a result of such tests, and due to the good work of metallurgists, particularly with regard to materials for turbines, "bursting" of a turbine or compressor impeller is now a very rare occurrence, even though the demand for a greater power output has resulted, in many cases, in higher running speeds and temperatures.



Loading 100 lb. weights onto the dead-weight direct-calibration device.



Diagrammatic illustration of the system employed for direct calibration of the statimeter and transmitter which are used to measure the thrust of power units on test.



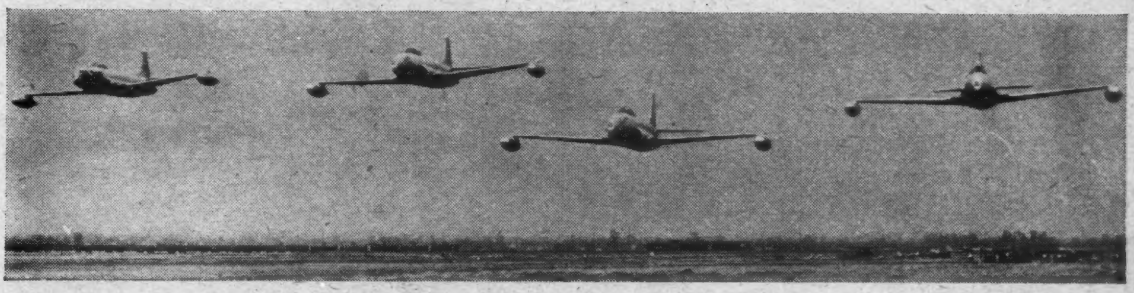
Bringing up the detuner tunnel to the jet nozzle.

Airscrew Turbines on Test

Airscrew turbines, unlike the pure jet-type power units, do present a more complex testing problem, not only because both shaft horsepower and jet thrust require to be measured but also because of the very high shaft power to be absorbed by the dynamometers. Additionally, starting, due to inertia, particularly if the design embodies an axial compressor, is a more difficult matter than for other types of power unit. The engine may be turned on the test bed with the use of its own airscrew shafts and say, an electric motor, but this entails driving through the reduction gear in the reverse direction, and relatively high power is required as the gear ratio is likely to be between 4 and 5 to 1.

Californian Air Display

Hesitation Rolls : Double-Dead-Stick Landings



Four of the many P.80 Lockheed Shooting Stars which the U.S. Army Air Forces demonstrated in excellent close formation flying and aerobatics at the Los Angeles air pageant at Mines Field.

AN air display probably one of the finest held anywhere since the war, was recently organized by the Los Angeles *Examiner* for some fifty thousand of the enthusiastic Californian public on Saturday and Sunday, June 1st and 2nd, at Mines Field—which is, incidentally, to replace Burbank as the airport of Los Angeles.

The high spot was undoubtedly fifteen minutes of superb aerobatics by two Lockheed P.80 Shooting Stars, flying in formation from take-off to landing. These were flown by Army pilots. Haze and imperfect radio communication hardly seemed to trouble them. Their ground level hoops, half-rolls, slow and flick rolls at 300ft, all showed that the P.80 is very manœuvrable when well handled.

But these evolutions were outshone by one that is new to us in England. In the U.S. they call it a "hesitation roll," but it might be better described as an "eight-station roll," for the aircraft is held for a couple of seconds at each of eight attitudes in stages of 45 degrees—while it scarcely departs from its axial path throughout. It is magnificent to watch, especially with a second aircraft closely following the first.

Another joy was a slow roll in level flight by a P-38 Lightning with one airscrew feathered. Lockheed's test pilot, Tony Le Vier, executed this superbly, sometimes remaining inverted half way through the manœuvre, and holding his axis of flight tightly throughout. On the Sunday he wound up his show by diving at the field with both airscrews feathered, pulling up into a stall turn, lowering his chassis and making a double-dead-stick landing.

There was some fine close formation work by squadrons of Army P-80s and the Navy did their best to beat this with an exhibition of aircraft-carrier take-off, attack and landing-on drill by sixteen jet-and-airscrew Ryan Fireballs. Their "opening-flower" evolution, which involved flying past in line astern while executing upward rolls, alternate aircraft to left and to right, was another graceful and difficult display.

B-29 Boeing "Superbombers"—as the Los Angelans call them—flying past in formation protected by squadrons of P-80s, made an impressive sight, and so did the Mustangs. The Army's R.5 helicopter was shown off in a way that only a very skilled pilot could achieve. The Douglas A.26 Invaders put up a good show, and their AD-1 Skyraider, with fuselage dive brake, was allowed a preview on this occasion. This is the Navy's newest "attack ship" and the dive brake, which is said to reduce its speed from 500 to 300 m.p.h., consists of three rectangular flaps on fuselage sides and belly, hinged at their leading edge and, to all reports and appearances, not causing any serious tail buffeting. The Skyraider carries either a 6,000lb bomb load, rockets, or torpedo. It demonstrated power wing-folding and unfolding while taxying.

After an unbelievable aerobatic show by Sandy Mason in his special Wasp Junior Stearman—he did an "eight-station roll," while flying straight and while in a turn, flick rolls in a turn, flick rolls from flying on his side and practically everything else—a Piper Cub was put through a crazy-flying act by Al Leary, who used to fly for Douglas.

The wind-up of the party was a concerted attack, in the Okinawa tradition, by Hellcats, Bearcats, Tigercats, Corsairs, Helldivers, Avengers of the Navy's Air Groups 5 and 98, and the Marine Group 33—all very polished.

The aircraft lined upon the ground included the big Douglas C.74 Globemaster (troop carrier version) with built-in crane, elevator and walkways, by which, through doors in the fire walls, all four engines can be reached in flight.

THE 29th R.A.F. V.C.

THE posthumous award of the Victoria Cross to Squadron Leader Arthur Stewart King Scarf, of No. 62 Squadron, commemorates an action of supreme heroism during the Malayan campaign 5½ years ago. It is the 29th V.C. to be gained by the R.A.F. in the Second World War.

In December, 1941, our small Air Force in Malay was making an all-out effort to check the Japanese advance. On December 9th, 1941, all available aircraft from R.A.F. Station Butterworth were ordered to make a daylight attack on the Japanese advance operational base. As they were on the point of taking off, enemy fighters and dive bombers made a combined low-level attack on the airfield and all our aircraft were destroyed or damaged with one exception—a Blenheim flown by Sqn. Ldr. Scarf, who had taken off seconds before the attack and was circling the airfield watching the disaster.

Instead of abandoning the projected operation, which should have been a formation sortie, Sqn. Ldr. Scarf decided to attack Singora single-handed. "Although he knew that this individual action could not inflict much material damage on the enemy, he nevertheless appreciated the moral effect which it would have on the remainder of the squadron who were helplessly watching their aircraft burning on the ground." Sqn. Ldr. Scarf successfully completed his attack, but the opposition over the target, which included many enemy fighters, was severe, and he was mortally wounded.

The enemy continued to engage him in a running fight and Sqn. Ldr. Scarf fought a brilliant evasive action in a valiant attempt to return to his base. As a result of his wounds he was unable to reach base, but made a successful forced landing at Alor Star without causing any injury to his crew. He was taken to hospital as soon as possible, but died shortly after admission." The citation concludes: "Sqn. Ldr. Scarf displayed supreme heroism in the face of tremendous odds, and his splendid example of self-sacrifice will long be remembered."

Sqn. Ldr. Scarf came from Wimbledon, entering the R.A.F. as a pupil in 1936.

CIVIL AVIATION

Viking Order : Constellation Snag : Wayfarer C. of A.

VIKINGS FOR DENMARK : Danish Air Lines—Det Danske Luftfartselkab (D.D.L.) have ordered five Vickers' Vikings for their London-Copenhagen service. This order is the first to be placed by a European country for any post-war British civil transport type.

ITALIAN AIR AGREEMENT

FOLLOWING the settlement of the dispute over the agreement proposed between Italy and American Trans World Airlines, whereby the latter would have obtained virtually a monopoly of Italian civil airline operations, discussions have now taken place between the U.K. and Italy resulting in an agreement under which British European Airways and the Italian Government will establish an Anglo-Italian airline operating company. The capital of the company will be £1,000,000 to which Italy will subscribe sixty per cent and B.E.A. forty per cent. It is understood that the company will primarily operate external airlines from Italy.

TECHNICAL HITCH

IT is reported that the United States Civil Aeronautics Board has ordered the use of the pressurization system in the Constellation to be suspended because of an alleged fire hazard in the present system of installation of the cabin supercharger. The decision has been made following an investigation of the accident to a Panair Constellation in America last week. The cabin supercharger is driven from the engine by a shaft and for the moment this shaft and its universal joints has to be completely removed, the juncture point of the shaft with the engine and supercharger adequately sealed, and the opening for the shaft in the fire-wall sealed off.

B.O.A.C.'s Constellations are, of course, involved in this modification, and consequently *Bangor II*, which should have taken off on a proving flight to New York from London Airport last Friday, was held up while spares and an engineer were flown from the United States to carry out the modification.

It appears that for the time being Constellations will be deprived not only of their pressurization system but also of all cabin heating, but whether or not these modifications will upset B.O.A.C.'s plans to start its regular transatlantic service on July 1 remains to be seen. At the moment the Corporation is still regarding July 1 as the inaugural date.

CIVIL SYNTHETIC TRAINING

NOWADAYS, while the cost of civil flying is, in the absence of a subsidy, so very high, the value of any form of synthetic training has been very much further increased. By using this form of training, with ground instruction generally, to the best advantage, it is possible to reduce considerably the flying time necessary to obtain the different licences.

Mr. Francis Chichester has recently joined the board of Straight Aviation at Bush House, and it will be his responsibility to apply the various ground training aids to civil requirements. Mr. Chichester, who was awarded the Johnson Memorial Trophy for his solo crossing of the Tasman Sea by astro-navigational aids has, of course, specialized in all forms of navigational ground training. During the war he compiled the Air Ministry notes for lectures on which the current training was based and, later, as Chief Navigation Officer of the E.C.F.S., evolved a course to produce navigationally self-sufficient pilots.

REPRESENTING GREAT BRITAIN : The United Kingdom Delegation to the recent P.I.C.A.O. assembly at Montreal are seen alongside *Baltimore*, one of B.O.A.C.'s new Constellations. In the group are (from l. to r.) Sqn. Ldr. Carter, Mr. Peter Masefield (Civil Air Attaché in Washington), Mr. L. J. Dunnett, Mr. H. G. Vincent, Air Chief Marshal Sir Frederick Bowhill, Sir Donald Banks (Chairman of the Delegation), Mr. J. R. McCrindle, Mr. M. E. Bathurst, Wing Cdr. G. L. Gandy, and Mr. R. W. N. B. Gilling, secretary to the Delegation.

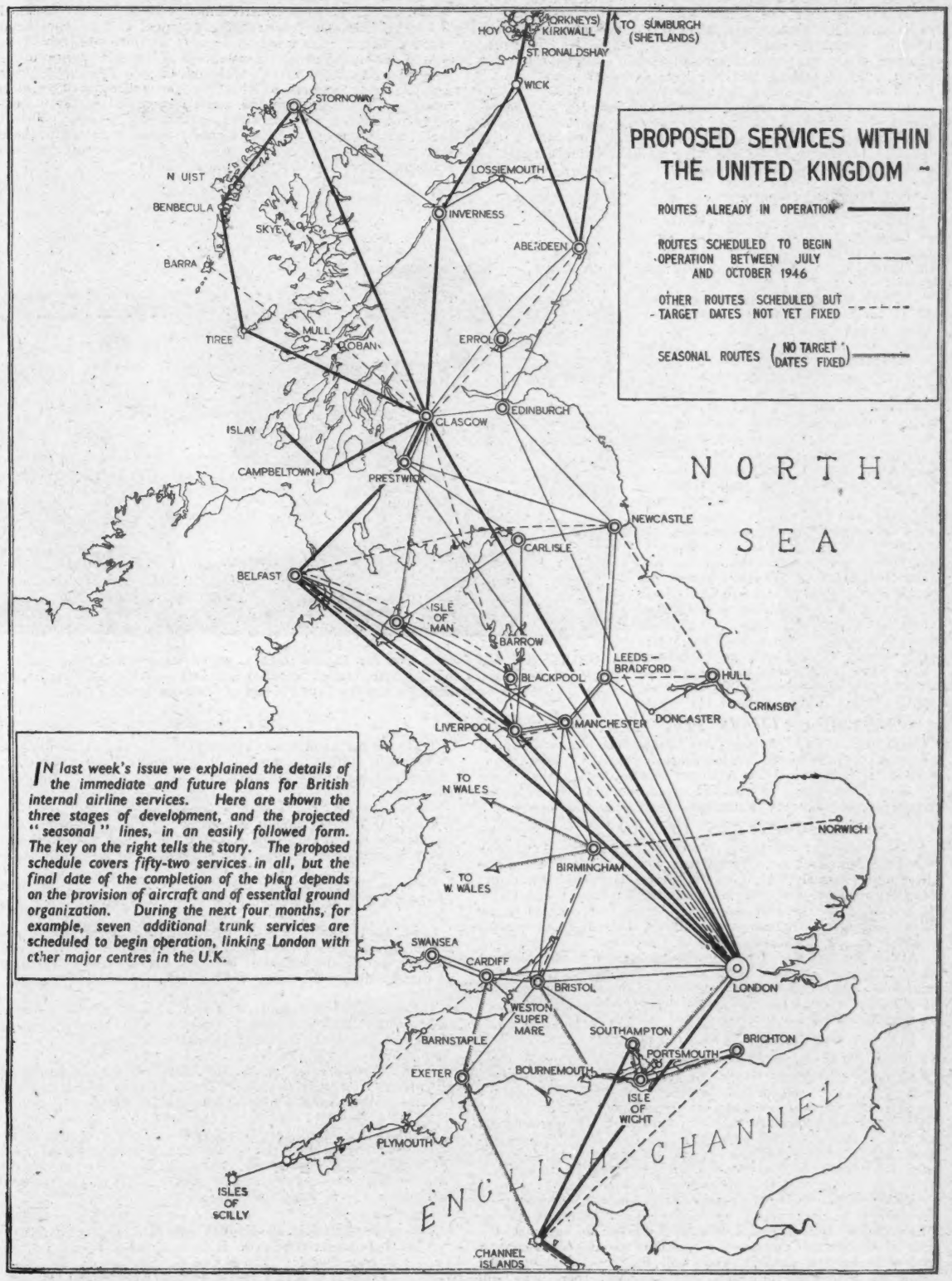
PAN-AMERICAN PLANS

WHILE in this country, on his way to Vienna on his company's inaugural flight to Central Europe, Mr. Juan Trippe, President of Pan-American World Airways, had one or two interesting remarks to make about American plans. He said that, as has already been announced, Pan-American would, in due course, be using Boeing Stratocruisers in place of Constellations.

He could not give even an approximate date when turbine-

(*Continued on page* 652.)

Britain's Internal Air Services



IN last week's issue we explained the details of the immediate and future plans for British internal airline services. Here are shown the three stages of development, and the projected "seasonal" lines, in an easily followed form. The key on the right tells the story. The proposed schedule covers fifty-two services in all, but the final date of the completion of the plan depends on the provision of aircraft and of essential ground organization. During the next four months, for example, seven additional trunk services are scheduled to begin operation, linking London with other major centres in the U.K.

CIVIL AVIATION

propelled transports might be in service on American air lines. In this connection, he added that, if Britain succeeded in developing such types first, his company would not hesitate to order them. He thought that the British air transport programme was sound, but that competition was bound to be severe when B.O.A.C. and Air France were, in addition to the American companies, flying the Atlantic.

He hoped that air transport fares in general would be reduced, since there was likely to be a considerable tourist traffic between the United States and Europe, and anticipated that separate tariffs would be necessary on long-distance routes—one for luxury sleepers, and another for "sit-up" travel.

BRISTOL 170's C. of A.

THE first unrestricted Certificate of Airworthiness to be issued for a British civil aircraft has been given to the Bristol 170. This aircraft, which is, available in two versions, the passenger Wayfarer and the Freighter, was test flown for the first time in December, 1945, and is now in production with a target of fifteen a month. Channel Islands Airways took delivery of the Wayfarer prototype last Saturday.

The original object of the 170 design was to provide a specialized freighter type, but this type now tends to take second place to the passenger version.

Demonstration tours for the Wayfarer have been planned and three production aircraft will be flown respectively in Canada, North and South America and the West Indies; in South America; and in Europe (including Scandinavia), the Middle East and Africa. The most ambitious of the demonstration tours will take the particular Wayfarer across the Atlantic, via Iceland and Greenland, and across the United States and Canada from New York to Seattle. Thereafter, the aircraft will be flown down the Western seaboard of the Americas to Buenos Aires. The aircraft which is being flown direct to Buenos Aires will take the usual route via Bathurst and Natal.

FRUITS OF VICTORY: The Air France Dakota, which inaugurated the Paris—Manchester service on June 17th, brought cases of fruit from Le Bourget. The Lord Mayor of Manchester and the Lord Provost of Glasgow flew to Paris.

CONSTELLATIONS FOR AER LINGUS

THE Irish Airline Company, Aer Lingus, Tta., has announced the purchase in the United States of three Lockheed Constellations for their trans-Atlantic service, which they hope to start next year. These Constellations are of the latest civil type, but delivery is not expected for several months.

OPPOSITION CHARTER

A NEW charter company, Westminster Airways, Ltd., has been registered with four Conservative M.P.s forming the directorate, namely, Air Comdre. A. V. Harvey, Grp. Capt. Max Aitken, Lt. Col. W. H. Bromley Davenport and Capt. M. Astor. The general manager of the company is to be Wing Cdr. Jack Duggan, who, before the war, was general manager of Wrightways, Ltd., at Croydon.

At the moment the company is using Heston as its base and has acquired a Proctor and an Airspeed Consul, but it is understood that the company expects to operate from Kenley in the future, undertaking charter flights to South Africa and to the Middle and Far East.

PRIORITIES EASING?

THE problem of priorities seems to be easing a little. For example, British South American Airways have now indicated that, as from July 1, they will be able to accept more non-priority passengers on their Buenos Aires service. This has been brought about, no doubt, by the introduction on this service of Yorks with their greater pay load. In addition, all B.S.A.A. passengers for Chile can now be accepted without priority and at the end of last week there was less than seven days' delay in obtaining a passage.

So far as the B.O.A.C.'s service to America, which starts on July 1, is concerned, the Parliamentary Secretary to the Ministry of Civil Aviation said in a speech recently at the Bristol Aeroplane Company's works that about 50 per cent of the seats on the Constellations will be free for commercial bookings. He also indicated that although there was still great stringency in services to the Middle East and India, he hoped that by the autumn priority control could be entirely relaxed everywhere.

"INTERNATIONAL" AIRPORT

THE service between Amsterdam and Basle is to be resumed by K.L.M. on July 1. The terminal will be Blotzheim Airport, which is situated in French territory between Basle and Mulhouse. Customs formalities at Blotzheim are to be reduced to a minimum to enable passengers to proceed direct into France or Switzerland without the complication of frontier-crossing. Vizas and luggage will be inspected whilst passengers are travelling on a special fast road service which will link the two cities with the airport. The Amsterdam-Basle schedule will be planned to connect with other air services from England, Scandinavia and Czechoslovakia.

BREVITIES

Trans World Airlines has appointed Sqn. Ldr. H. Ellul to be its assistant station manager at Orly Airfield, Paris. Sqn. Ldr. Ellul was for many years in the traffic department of Imperial Airways.

* * *

The Chilean Government is considering the establishment of an air service to Australia via Easter Island. Negotiations for reciprocal landing rights are understood to be in progress.

* * *

Between March and June this year, the total weight of freight carried by K.L.M. increased by over 400 per cent.

* * *

Capt. L. J. Brain, A.F.C., who has been Operations Manager for Qantas Empire Airways and who served in the R.A.A.F. Reserve during the war, has been appointed General Manager of the Australian National Airlines Commission.

* * *

Tasman Airways expects to begin a daily service between Sydney and Auckland within the next three months, using Short Sunderland Mark V flying boats.

* * *

Indian girls are being used by Tata Airlines of India, as air hostesses on their services. The girls were trained initially by one of the Trans-World Airlines' senior hostesses.

* * *

If the reduced fares for the transatlantic air crossing, recommended at the North Atlantic Traffic Conference recently, are ratified by the Governments concerned, the single fare on the London-New York service will be cut from £93 to £80 15s, and the return fare to £145 15s.

* * *

At the Heliopolis English School:
Teacher: "Are you R.C. or C. of E.?"
New Pupil: "I'm B.O.A.C., Sir."
(From B.O.A.C.'s House Journal *Speedbird*.)

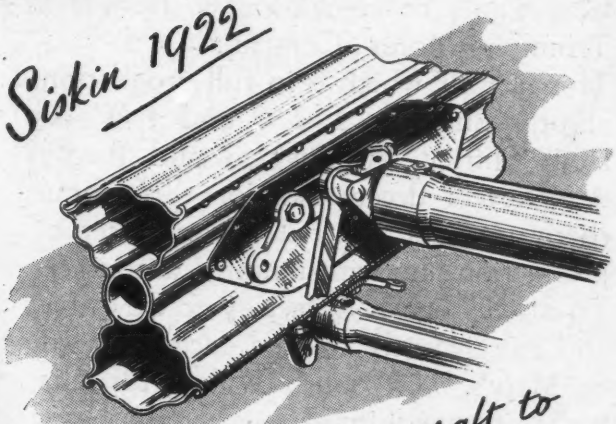
AWA

ARMSTRONG WHITWORTH AIRCRAFT
COVENTRY

Pacemakers of Progress

ACHIEVEMENTS NOTEBOOK

Siskin 1922

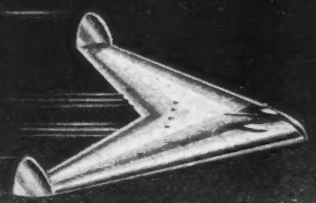


First all-steel aircraft to go into production!

A.W.A. Designers were pioneers in the use of all-metal construction, and the famous Siskin and Atlas aircraft were renowned for their constructional efficiency and sturdiness in long service.

No. 1

and now the Flying Wing



BRANCH OF HAWKER SIDDELEY AIRCRAFT CO. LTD.

Cogent H.101

Announcement

* * * *

We have acquired
an extensive factory premises at Clay Lane, Stoke, Coventry, from the Triumph Motor Company.
This factory, which is in full production, absorbs our Nos. 1, 2, 3 and 4 Works from Shirley, Birmingham and Rugby. A policy of decentralisation throughout the war years ensured a continuity of production, notwithstanding air attack. To-day, in our new factory at Coventry, and the recently opened factory at 73, St. Mary's, New South Wales, Australia, we are fully equipped to meet the heavy demands of world markets, in addition to those of British Industry at Home. All orders and correspondence should be addressed to Coventry.

BOM

B. O. MORRIS LTD.

Morrisflex Works

CLAY LANE, STOKE, COVENTRY

Telephone: Coventry 5081. 'Grams: Morrisflex, Coventry

REGD. OFFICE - SHIRLEY - BIRMINGHAM

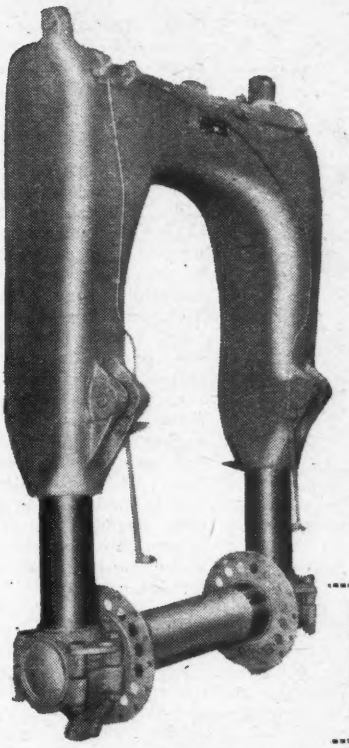
REX - - - Rotary Files and Cutters

MORRISFLEX - - - Flexible Shaft Equipment

MORREX - - - Rotary Wire and Fibre Brushes

Messier Hydraulics

Survey of the High-pressure Hydraulic System Installed in the Handley Page Hermes / Hastings



Main undercarriage leg showing neat design of magnesium-alloy bridge casting, and mounting points.

Tailwheel assembly showing relation of components and robust design.

THE development of aircraft in past years, particularly in the larger categories, has brought in its train so many ancillary services of diverse character that means for power operation had to be devised; this led to the inclusion of hydraulic and electric power systems to aid human muscles.

Although there is still some sort of rivalry between the protagonists of the two basic power systems, it is now generally recognized that there are certain advantages inherent in each, and that, obviously, the sane thing is to combine the best features of both. For this reason, among others, Messier Aircraft Equipment, Ltd., the well-known hydraulic and undercarriage manufacturers, have changed their name to Electro-Hydraulics (Messier), Ltd., and intend to concentrate on wedding electrics and hydraulics together to produce the best form of power service possible for any given application.

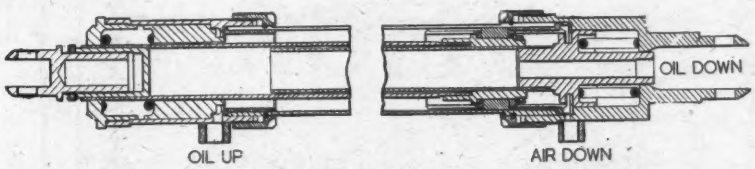
The hydraulic system used on the Hermes and Hastings is, however, a slightly modified version of that employed on the Halifax, and, consequently, the "electro" part is quite small. Power is supplied by the main inboard engines, each of which drives a Lockheed Mk VI positive-displacement piston-type pump, the delivery being to an automatic cut-out valve and thence into the main system. The cut-out valve is a "pressure-gate" which maintains a static pressure of 2,500 lb/sq in in the system. This is done through the agency of a hydraulic accumulator consisting of a cylinder divided into two compartments by a free-floating piston, on one side of which is compressed air and on the other side hydraulic fluid from the system.

When a service is selected, e.g., undercarriage retraction, the static pressure stored in the accumulator is opened to the undercarriage actuating jacks, which thereupon start to move, and the pressure in the accumulator begins to fall. Immediately the pressure has dropped to 2,000 lb/sq in, the cut-out valve automatically opens the pump delivery back into the system until the 2,500 lb value is again reached, when the cut-out once more operates and diverts the pump delivery back into the fluid supply tank.

"Supercharging" for Altitude

Since the pumps are working all the time the inboard engines are running, and, obviously, their delivery is not required except at odd intervals when a service is selected, the diversion of delivery back to the supply reservoir can be regarded as an idling circuit. As the installation is a high-pressure system, an electric booster pump is fitted to the reservoir tank, "supercharging" the suction line to each engine-driven pump so that cavitation does not occur at high altitudes.

Both the main and tail undercarriages are raised and lowered by double-acting jacks, and the selector by means of which their operation is initiated comprises a casing in which are four poppet valves operated by a rocker-arm moved by the selector handle, one pair of valves being opened for each selection. One of the pair admits pressure fluid to



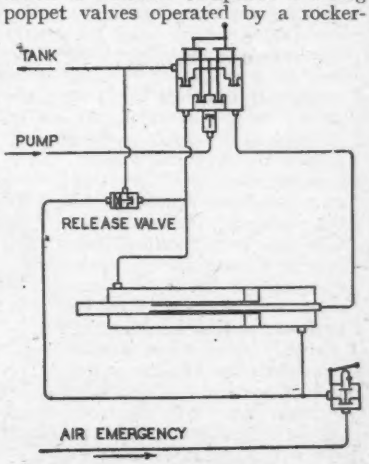


Fig. 1 (above). Detail section through main undercarriage jack showing oil and emergency-air actuation principle together with ingenious locking arrangements. Fig. 2 (right). Diagram of hydraulic and emergency-air system for undercarriage operation.

MESSIER HYDRAULICS

one side of the jack piston, whilst the other valve permits the escape back to reservoir of the displaced fluid on the other side of the piston. For the converse selection the jack piston moves in the opposite direction since the fluid flow is reversed.

In an emergency, should the hydraulic power supply for any reason fail, the undercarriage and flaps may be operated by compressed air stored in bottles, although the emergency air systems for the two services are separate entities. The undercarriage system comprises a bottle supply of air compressed at 1,450 lb/sq in, which is delivered to the jacks through separate pipe lines and, in addition, actuates the jacks without impinging on the normal oil space. This is effected by the use of jacks of the type shown in Fig. 1, in which the hydraulic operation is brought about by means of a third jack tube inside the piston rod, and the pressure therefore operates on the cross-sectional area of this tube. The emergency air system operates by introducing the compressed air into the annular space between this rod and the cylinder, whilst the hydraulic contraction of the jack is effected by oil pressure acting on the annular underside of the piston.

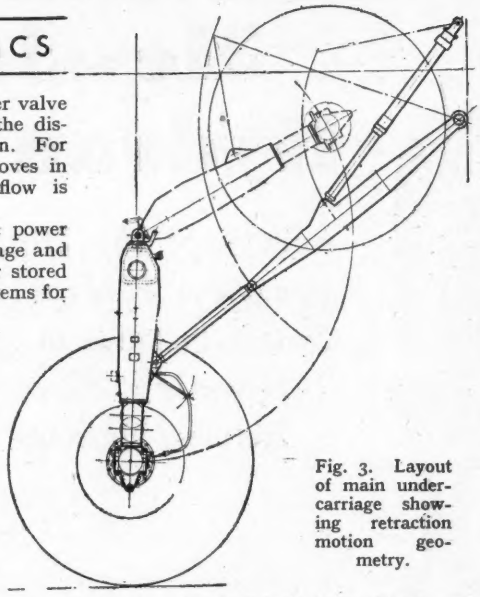


Fig. 3. Layout of main undercarriage showing retraction motion geometry.

The system is diagrammatically shown in Fig. 2, and, as may be seen, is controlled by a small selector which, in its normal position, vents the air side of the main and tail undercarriage jacks to atmosphere and seals the air in the emergency bottle. In the emergency down position the vent to atmosphere is closed, and the compressed air is admitted to the jacks, thus lowering the undercarriages. To allow fluid to escape from the jacks should the main hydraulic selector not be in the "down" position, a release valve is installed. This consists of a piston, moved by the compressed air used for emergency actuation, which opens a valve and allows fluid in the jacks to be displaced back to reservoir, by-passing the selector.

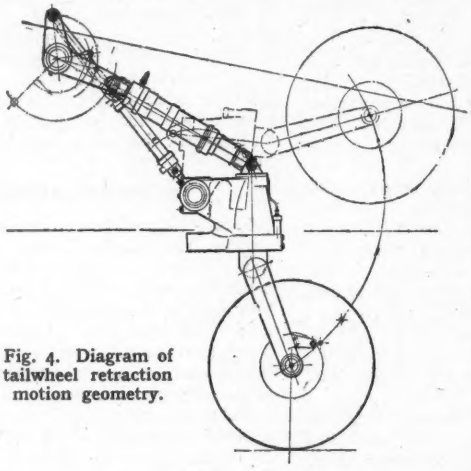


Fig. 4. Diagram of tailwheel retraction motion geometry.

When the aircraft has landed, the emergency selector is moved back to normal, the air in the jacks escapes to atmosphere, the release valve, being spring-loaded, re-seats itself and, assuming that the fault which led to the emergency system being used has been rectified, the system is ready for use again once the air bottle has been reinflated; it may thus be appreciated that the bleeding normally required in similar circumstances by the usual run of hydraulic systems is, in this case, not required. As an added precaution, in the extremely rare event of both hydraulic and pneumatic failure, the main and tail undercarriages can be lowered by the hand pump.

The "up" and "down" locks on the main undercarriage jacks, as shown in Fig. 1, are of special interest. On each side of the rod piston are radially sprung skirt with projecting chamfered rims which, at the appropriate stroke extremity, spring over a butting face and are prevented from disengaging by a radial lock-bolt spanning the skirt bore. When a selection is made and pressure applied to the appropriate side of the jack piston, the initial movement is made by the lock-bolt being lifted against its spring pre-loading, so freeing the spring skirts and enabling the piston rod to move. The tail undercarriage is similar, but an internal mechanical lock is provided only for the "down" position, as the unit is maintained in the "up" position by hydraulic pressure.

Retraction geometry for the main undercarriage is shown in Fig. 3. When the wheel is locked down, the breaker-strut radius rods are slightly over-centre, and landing loads are transmitted through these members and not through the jacks themselves. Tailwheel geometry is shown in Fig. 4; as the jack closes, the fork swivel-housing pivots about its hinge axis, thus raising the wheel. Times for undercarriage raising and lowering are as follows: Normal up, 13 sec; normal down, 7.5 sec; emergency down, 14 sec.

Shock absorption for both main and tail undercarriages is accommodated by straightforward oleo-pneumatic members which differ only in minor detail. Main-leg bridge-castings each accommodate two shock absorbers, one in each leg of the bridge, as shown in Fig. 5. The telescopic members of each leg proper are supported by bearing lands inside each bridge leg, the shock absorber unit being carried as a separate component co-axially within the leg so that it is subject only to end-loads, any bending loads being taken by the lower leg member relative to the bridge casting.

In essence, the shock absorber consists of a telescopic

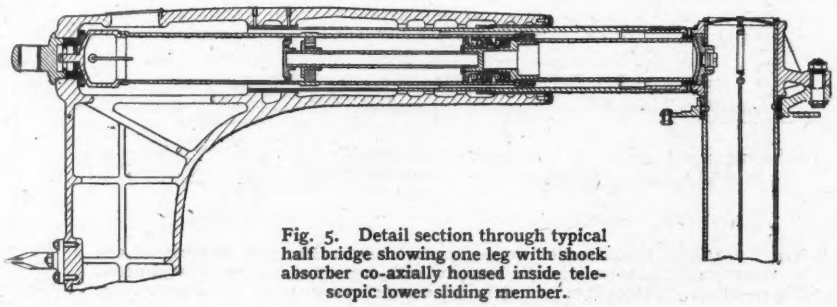


Fig. 5. Detail section through typical half bridge showing one leg with shock absorber co-axially housed inside telescopic lower sliding member.

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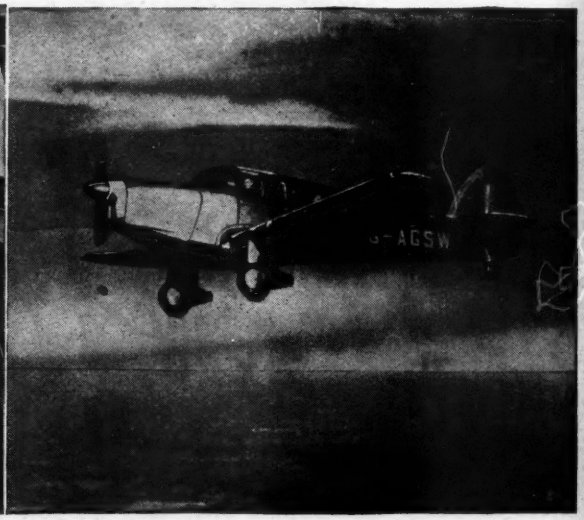

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cylinder having spring-loaded, cup-type leather seals at the piston head of the lower (inner) member. Extending above this piston is a rod piercing a fixed diaphragm and terminating in a second piston head, through which oil passages are drilled. The fixed diaphragm also incorporates oil drillings, some of which are appropriately closed by a clack valve; above the top piston is the compressed-air space. Oil is enclosed in the annular space between the upper and lower pistons, with a shallow layer of oil above the top piston to preclude emulsifying. On the application of compressive load with the piston assembly of the lower member being driven into the upper tube, the oil is forced through the drillings in the fixed diaphragm and upper piston so that air in the space above the oil is compressed. The energy thus built up is liberated in driving the piston assembly downward for the reverse stroke, the damping action being obtained by the clack valve closing some of the drillings through the diaphragm so that oil flow is restricted.

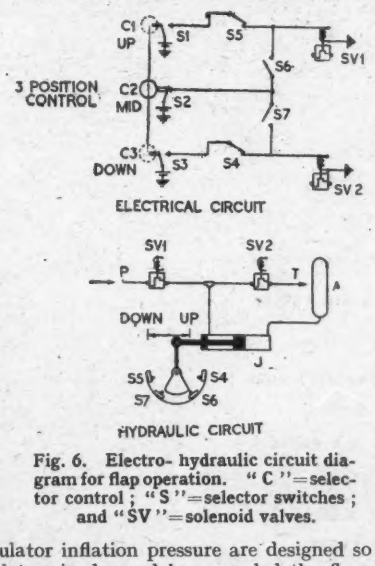

Fig. 6. Electro- hydraulic circuit diagram for flap operation. "C"=selector control; "S"=selector switches; and "SV"=solenoid valves.

The electro-hydraulic elements of the system are comprised in the flap-operating circuit. Flaps are actuated by a single jack, a mechanical linkage ensuring synchronization; they are raised by main circuit pump delivery but are lowered by the energy stored in the separate flap-system accumulator. The linkage and accumulator inflation pressure are designed so that should a pre-determined speed be exceeded the flaps will "blow shut" and no mechanical damage will ensue.

Three selection positions are provided, viz., "up," "down" and "maximum lift." The principle of operation can be followed by reference to Fig. 6. Two solenoid valves, S.V.1 and S.V.2, are mounted in one unit (Fig. 7), and are both normally closed, but open when the solenoids are energized. The switches S.4, S.5, S.6 and S.7 are housed in one unit and are cam-operated by a shaft rotated by the flap linkage. Assuming the flaps to be in the "down" position, then switches S.4 and S.6 are respectively open and closed. If then the "up" position, C.1, is selected, S.V.1 is energized and fluid from the pump closes the jack; when the flaps have reached the "up" position, S.5 and S.7 are respectively open and closed and S.V.1 is, therefore, de-energized. To prevent the flaps rising too quickly and also to ensure that the speed of rising is constant, a flow-control valve is installed before S.V.1 so that a constant flow through the flap jack is obtained. The valve is shown in Fig. 8 and depends for its action on a pressure drop across the orifice in the piston. The valve in the return-to-tank line, and the spring, ensure both that a constant pressure drop across the orifice, and, hence, a constant flow is obtained.

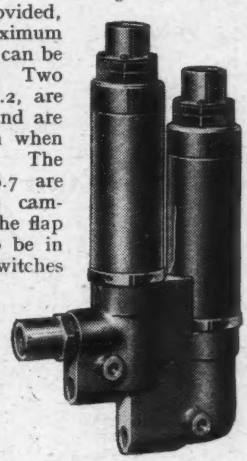

Fig. 7. Flap-selector solenoid-valve unit. Both valves are normally closed, but are opened when the solenoids are energized.

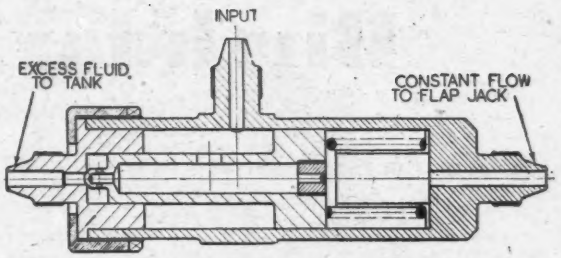

Fig. 8. Detail section through hydraulic constant-flow valve by means of which flap movement is kept at right speed.

Flap lowering in an emergency is effected by compressed air by means of a similar selector to that used for emergency undercarriage lowering. Compressed air from a separate bottle supply acts on an air relief valve which, when operated, allows fluid from the jack to return to reservoir, and the flap lowering is then accomplished by the energy stored in the accumulator.

N.P.L. EXHIBITION

THE work of the National Physical Laboratory at Teddington is, to a great extent, taken for granted in the same way as the work of other scientific research organizations. Thus it is with a sense of enlightenment that one appreciates the scope of the N.P.L. activities as demonstrated by the exhibition held there on June 19th, 20th and 21st.

The scope of the exhibition may be appreciated from the fact that the scientific work of the laboratory is conducted in ten divisions: aerodynamics, electricity, engineering, light, mathematics, metallurgy, metrology, physics, radio and ship. In the time accorded to our visit little more was possible than a brief inspection of the various wind tunnels.

The first of these was the Duplex tunnel to which is fitted an extremely ingenious six-component balance for the measurement both of moments and forces in the three planes of motion of the model under test. Secondly come the two open-jet tunnels, on the first of which wake-test investigations of an aircraft carrier were in progress, whilst on the companion tunnel a study was being made of the smoke emission characteristics of a new Scottish power station to determine the optimum sighting and height of the chimneys. Another interesting exhibit in conjunction with this tunnel was a display of spin screens for open ports. These are simple four-blade windmilling fans of very low pitch, the blade form of which is designed to deflect the air radially; behind the fan (i.e., on the inside of the port) is a wire mesh guard, and so effective is this device that an observer can look through the fan out of the port in the face of a 70-knot gale without feeling any wind on his face at all.

In the high-speed laboratory are the tunnels which readers may remember were referred to by Mr. Relf in his recent Wilbur Wright Memorial Lecture. These tunnels differ in capacity and speed and are fitted with exhaustive measuring and indicating apparatus such as multitube manometers for pressure plotting, and shadowgraphs and Schlieren devices for the graphic illustration of shock waves and flow disruption.

Probably the most spectacular department in the aerodynamics division is the whirling arm, which is a most beautifully designed and built piece of apparatus. As its name suggests, it is a radius arm at the outer end of which the model to be tested is mounted, and the arm is then rotated up to a speed of 100ft/sec at the model. Air pressures and strain gauge readings are transmitted to the arm hub and conducted through ingenious mercury transfer units, for the air pressures through labyrinth seals and for the strain gauge circuits by a copper dipper.

Investigations in progress in other tunnels included the study of lift and drag characteristics of special thick sections with boundary layer suction; flow studies of breakdown from laminar into turbulent flow by the "china clay" method; boundary layer studies by the smoke emission method; and wake characteristics from an oscillating aerofoil under differing conditions of air speed, incidence, and amplitude and frequency of roll.

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Flt. Sgts. C. Macey, R.A.F.V.R.; J. E. Ogden, R.A.F.V.R.; C. E. Simpson, R.A.F.V.R.

Sgts. E. Dawson, R.A.F.V.R.; B. E. Woodin, R.A.F.V.R.

BRITISH EMPIRE MEDAL

Military Div.

ROYAL AIR FORCE.

Flt Sgts. A. E. W. Austen; N. J. Batchelor, R.A.F.V.R.; R. S. G. Bees, R.A.F.V.R.; H. G. Bennetts; R. A. Camble, R.A.F.V.R.; G. G. C. Clark; E. A. Close; F. L. Coldron; J. A. Coward, R.A.F.V.R.; A. R. V. Dash, R.A.F.V.R.; D. Edward; N. McK. Fairgreive; H. J. Freestone; H. S. E. Gale, R.A.F.V.R.; J. Gilmour, A.A.F.; J. Harding, R.A.F.V.R.; E. Jarrett; A. G. John; P. McBride, R.A.F.V.R.; G. W. May; C. H. Peacock, R.A.F.V.R.; L. J. Pursey; C. I. Richards; J. S. Robertson; E. Senior, R.A.F.V.R.; G. W Stephenson; J. R. Walker; J. Walsh, R.A.F.V.R.; L. Wood.

Act. Flt. Sgts. J. Arnold, R.A.F.V.R.; J. Butchart, R.A.F.V.R.; R. Clacher; H. R. Davies; S. C. Drewe; N. S. Dyson; W. J. Hicks, R.A.F.V.R.; H. Kern, R.A.F.V.R.; J. S. Moodey, R.A.F.V.R.; N. E. Notley; C. J. Payne; J. R. Rimmer, R.A.F.V.R.; R. H. Smith, R.A.F.V.R.; E. A. Snodin, R.A.F.V.R.; C. F. Thomson; E. T. Willson.

Sgts. R. P. Allen, R.A.F.V.R.; J. G. Atterbury, R.A.F.V.R.; J. Beesley, R.A.F.V.R.; K. J. Chandra, R.I.A.F.; L. C. Cheetham, R.A.F.V.R.; E. W. Cooke, R.A.F.V.R.; G. R. Courtnadge; J. B. Dow, R.A.F.V.R.; W. F. Dowie, A.A.F.; J. W. Dowse; H. Y. Gregory, R.A.F.V.R.; P. G. Hann; H. Hodgson; R. Jeavons, R.A.F.V.R.; L. F. Johnson, R.A.F.V.R.; H. Jones; F. C. King; J. S. King; R. C. Long, R.A.F.V.R.; W. H. Medley, R.A.F.V.R.; P. D. Norwood, R.A.F.V.R.; F. C. Perry, A.A.F.

G. R. Pipkin, R.A.F.V.R.; W. J. Powell, R.A.F.V.R.; E. K. Randall, R.A.F.V.R.; S. E. Reed, R.A.F.V.R.; D. A. Roast; H. W. Rogers, R.A.F.V.R.; L. H. T. Rowe, R.A.F.V.R.; C. W. Rushmore; M. E. Sanford; D. Scobie, R.A.F.V.R.; G. T. Smith, R.A.F.V.R.; G. J. Taylor, R.A.F.V.R.; D. B. Thomas, R.A.F.V.R.; C. W. Truefitt, R.A.F.V.R.; L. H. Turner; J. C. Vaughan, R.A.F.V.R.; W. G. H. White; E. S. Whitworth, R.A.F.V.R.; T. Williamson, R.A.F.V.R.; R. W. Wills; J. G. Scott, S.A.A.F. Act. Sgts. K. E. Butler, R.A.F.V.R.; A. L. McIntosh, R.C.A.F.; H. Masson, R.A.F.V.R.

Cpls. G. Atack, R.A.F.V.R.; E. E. Buckle, R.A.F.V.R.; R. W. M. Chalmers, R.A.F.V.R.; W. Chaplain, R.A.F.V.R.; E. J. Cooper, R.A.F.V.R.; W. F. Cottrell; N. D. Drake, R.A.F.V.R.; R. L. Evans, R.A.F.V.R.; J. L. Flint, R.A.F.V.R.; K. C. Gomm, R.A.F.V.R.; N. Hall, R.A.F.V.R.; R. C. Harding, R.A.F.V.R.; K. J. Harvey, R.A.F.V.R.; G. Ibbetson, R.A.F.V.R.; R. J. Irving, R.A.F.V.R.; L. E. Johnson, R.A.F.V.R.; H. J. Merrylees, R.A.F.V.R.; R. Nicholson, G.M., R.A.F.V.R.; G. G. Rushin, R.A.F.V.R.; E. S. Walker, R.A.F.V.R.; T. Wharton, R.A.F.V.R.; F. J. Wood, R.A.F.V.R.

Act. Cpl. A. G. Borrett, R.A.F.V.R.

L.A/C.s A. A. Brann, R.A.F.V.R.; G. W. Dale, R.A.F.V.R.; R. Eastwood, R.A.F.V.R.; E. A. Gale, R.A.F.V.R.; R. A. R. Mills, R.A.F.V.R.; A. Summers, R.A.F.V.R.; H. Tattersfield, R.A.F.V.R.; R. J. Wilcock, R.A.F.V.R.

W.A.A.F.

Flt. Sgts. V. M. Gregory; T. Howard; K. M. Quinn; Act. Senior Sgt. M. W. Sworder, SOUTHERN RHODESIAN W.A.A.F.; Sgts. J. H. Abbott; A. H. Cuthill; H. R. Gerrard; G. A. Horrocks; G. E. Stone.

Cpls. I. Auburn; K. G. Barrington; R. Hesketh; A. W. Jones; M. Lemar; V. N. Loftus; M. H. Monteith; C. N. Nelson; C. F. Sadler; E. P. Vorley; V. Wilkinson; Act. Cpls. E. M. Leaver; S. A. G. Speed; L.A/CW. V. M. Brereton; M. M. McLaren.

ROYAL NAVY.

Ch. P./O. Air Fitter (A) A. E. Green, D.S.M.; P./O. (Act. Aircraft Boatswain's Mate) D. J. Kimber; Air Art. Third Class G. W. Martin; Act. Ch. Air Art. D. N. Owen.

ARMY AIR CORPS.

Colour Sgt. R. A. Jenkins; Sgt. (Act.) A. H. Crain.

TRANSPORT COMMAND AIRSCREW TESTS

IN order to ensure that every member of Transport Command aircrews operating along the trunk routes is capable of performing his exacting task with complete safety, an Aircrew Examining Unit has been set up within the Command. Its duty is to carry out periodic checks on the flying efficiency of the various crew members.

Based on the results of both flying and ground tests, the capability of each pilot is classified under categories "A" and "B." The flying examination includes tests in general flying, instrument and night flying. The eight subjects in the ground examination are: Knowledge of aircraft, meteorology, weight and balance of load, air-sea rescue, radio aids, passenger-handling and briefing, air traffic and aircraft papers.

A marking of 90 per cent and over on all subjects gives category "A," and between 75 per cent and 89 per cent results in the grading "B."

As far as Transport Command is concerned, the "P/O. Prune" figure, with his shapeless cap and battered uniform, is now a thing of the past, for pilots are also assessed on appearance, bearing and discipline.

Before a pilot is allowed to carry passengers, certain flying qualifications are necessary. These are:—

For four-engined aircraft.

(a) 1,000 hours as pilot.

(b) 200 hours as a four-engined captain of which 50 hours must have been done on night flying.

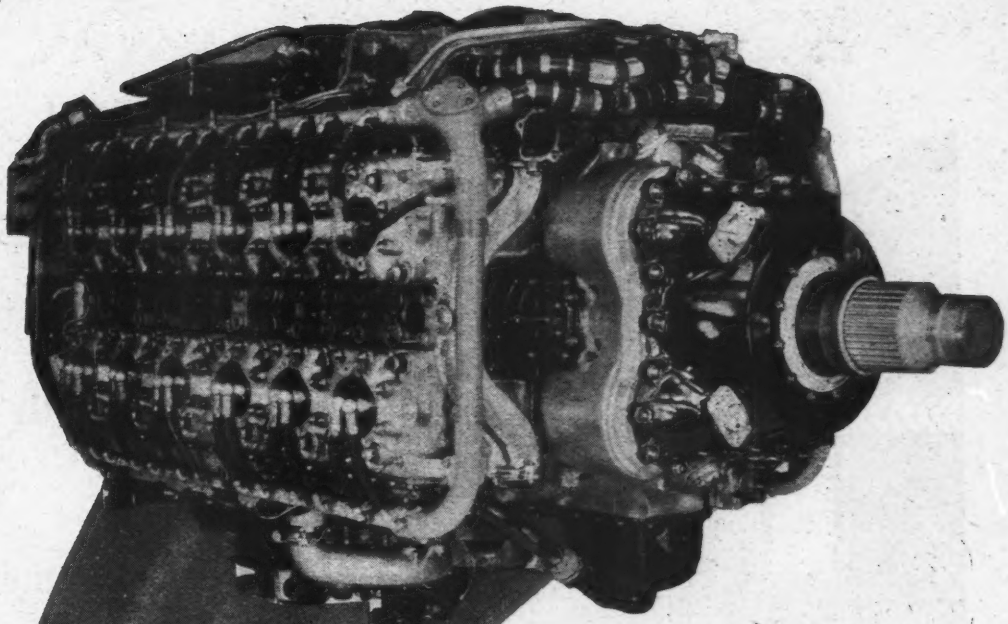
(c) 100 hours' captaincy on the particular type he is flying, with 20 hours' captaincy at night.

For twin-engined aircraft.

(a) 850 hours as pilot.

(b) 200 hours as captain of a twin- or four-engined aircraft, including 50 hours at night.

(c) 100 hours' captaincy on the particular type he is flying, including 20 hours at night.



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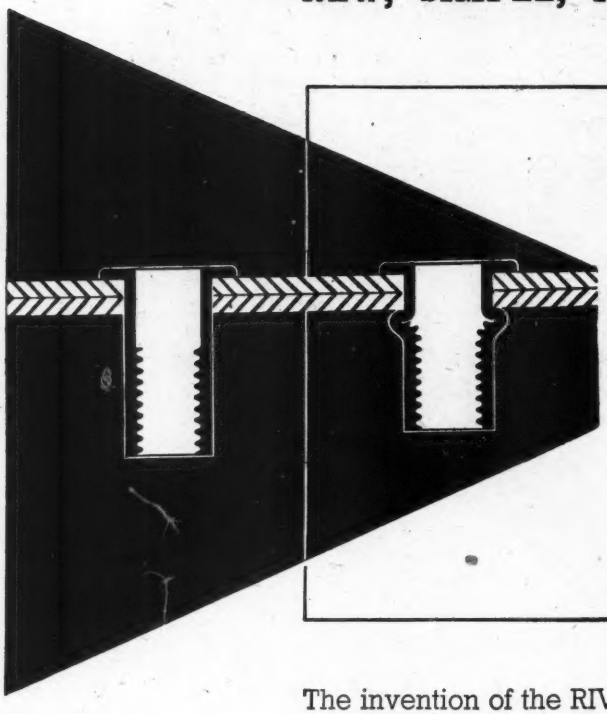

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The invention of the RIVNUT constitutes an entirely new and ingenious approach to fastening problems. The RIVNUT is an internally-threaded and counter-bored rivet which can be installed from one side of the workpiece. The RIVNUT is not only a perfectly balanced blind rivet when upset, but the threaded portion provides a permanently fixed nut as well, so that further attachments can be made from the work-face, with a screw or bolt.

Rivnut

A booklet on the RIVNUT, giving many details and enabling you to study the many uses and applications of the RIVNUT with regard to your own interests, has just been published. Linread (Advisory Service) will also gladly advise you on any fastening problems you would like to discuss. Please write for this booklet to Linread Limited, Department RE Sterling Works, 26-33 Cox Street, Birmingham 3.

THE NEW BLIND SCREW FASTENING METHOD

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

ACTUARIAL DIGRESSION

Number of Passengers is Immaterial

WITH regard to "Indicator's" article in *Flight*, May 23rd, I think he will find that several leading insurance offices, including my own office, do not vary their premium rates with the number of passengers carried in an aircraft. It is immaterial, from the point of view of premium, whether an individual insured person is one of ten passengers or one of a hundred.

F. L. PITT (F.C.I.I.).

VICTORY FLY-PAST

Training Command Left Out

AS a very reluctant member of Flying Training Command, I should like to raise a small voice of protest amidst the cheers that greeted those famous squadrons that sped over the Mall on June 8th.

The Victory Parade was representative of the people of this country and the Services. Why, then, should a flying command be overlooked in the fly past.

Flying instructing is no sinecure, and although I do not begrudge those operational types their place, I would venture to point out that even *they* had to learn sometime. The lowly Tigers, Harvards and Oxfords, to mention only three, did, and are still doing, yeoman service, and I feel sure that there was no need to overlook recognition on such an occasion, particularly as all of us would have given a good deal to have been posted to a squadron in place of our pupils.

A FLYING INSTRUCTOR.

THE JAMESON AIRCRAFT ENGINE

The Designer Replies to Comments

WE thank "M.I.A.E." for his kind remarks regarding the figures obtained on development test. He states that what occurs in the induction pipe is a debatable point. It is agreed that this is very difficult to prove directly, but we submit that if an engine with cool induction system can be weakened off at full throttle until misfiring commences, with no popping back, this is evidence that the mixture strength is too weak at the beginning of the induction stroke to enable flame propagation to continue in the pipe, and that there *can* be such a thing as a "ventilated" engine.

J. L. JAMESON, Director,
Jameson Aero Engines, Ltd.

FLIGHT OF BIRDS

The Leader Does Not Necessarily Hold the Position for Long

READING—a little late, I fear—Mr. Stanley Bradshaw's letter in your issue of May 9th on the "V" formation flight of some migrating birds, I was surprised at the time that no mention was made by the Brains Trust of this fact:—

At school I was told—and I have witnessed it many times—that the leading bird does not in fact keep the lead for very long. I have seen this bird drop back to the end of a "wing" after a matter of seconds rather than minutes, and its place taken by one of its neighbours. This would seem to confirm that the reason for the formation is aerodynamic.

Y. LABYE.

Confirmation of the "Strongest Leader" Theory Demanded

ONE would be more ready to be convinced that Mr. A. R. Forrest's suggestion about the V formation adopted by some birds was anything more than mere speculation if he would be kind enough to tell us something more of the "observation" held to "confirm" his theory and of how it is interpreted.

It would be interesting to know in what way the following birds "appear" to be aided by the slipstream of the next ahead; and if this is really so, why they don't fly in line astern rather than in "V" formation, and why some birds do this and not others? It is of singularly little use to pontificate about the "limitations" of "orthodox" theory, unless particular theorems and the particular circumstances which render them inapplicable are clearly specified. What exactly *is* Mr. Forrest referring to?

H. M. YEATMAN, A.F.R.Ae.S.

RADIO RECORDS

Long-distance Communication in the Pacific

I WAS most interested in the paragraph appearing in *Flight* of June 13th (page 591) claiming a long-distance record for C.W. communication between aircraft and ground stations.

Whilst stationed in San Diego, California, U.S.A., last year, with the R.A.F.T.C. I made many two-way contacts which exceed the distance given in your article. We were operating the RY3 (Liberator) from San Diego to Sydney, Australia, on regular schedules. Immediately after becoming airborne and reaching cruising altitude I would call Musick Point Radio in Auckland, New Zealand, establish two-way communication, and pass a departure signal for the benefit of the staging-post there.

Furthermore, I would have hourly Q.S.O.'s with Musick Point until reaching Honolulu. The distance (Great Circle) of my first contact is 5,700 statute miles, or 4,950 nautical miles. Frequency used was 8 Mcs. Equipment was the standard American liaison transmitter B.C. 375, made by the General Electric Company.

This was no freak of reception since I was able to make the contact on all trips.

C. B. G. KNIGHT (F/L., R.N.Z.A.F.)

RECENT AERODYNAMIC DEVELOPMENTS

Acceleration Problems as a "Second Barrier"

IN connection with the second part of the Wright Memorial Lecture given by Mr. E. F. Relf, I should like to mention another barrier to the attainment of very high speeds—the barrier of acceleration. I think this point to be of nearly as much importance as that of temperature rise.

The use of the athodyd (aerothermodynamic duct) will, according to Mr. Relf, involve an assistant power source for take off and to attain the desired speed in the shortest time. In this case, and in pure rocket-driven aircraft, accelerations are, of course, very high, not only for take-off runs, but also in manœuvring at very high speeds.

As an example I took the American ionosphere rocket. Maximum speed about 3,000 m.p.h. at 18.94 miles. Endurance at full flow approximately 70 seconds. That means an acceleration of approximately 265 ft/sec², if my calculations are right. I wonder a human body can stand such figures. Naturally, this point is of no interest in radar-controlled aircraft. But what about a supersonic airliner? I hope that one of your correspondents can give me some data on the piloted "Viper," to give a recent example of the accelerations to which the human body is exposed.

M. C. QUIST.

Rijswijk, Holland.

MORE ABOUT APPRENTICES

Wartime Disadvantages: Dashed Cranwell Hopes

THE copies of *Flight* containing letters on the much-debated subject of aircraft apprentices have just arrived in Malta and have given rise to a great deal of discussion. May we, as two "ex-Brats," add yet another point to those contained in the letters you have published?

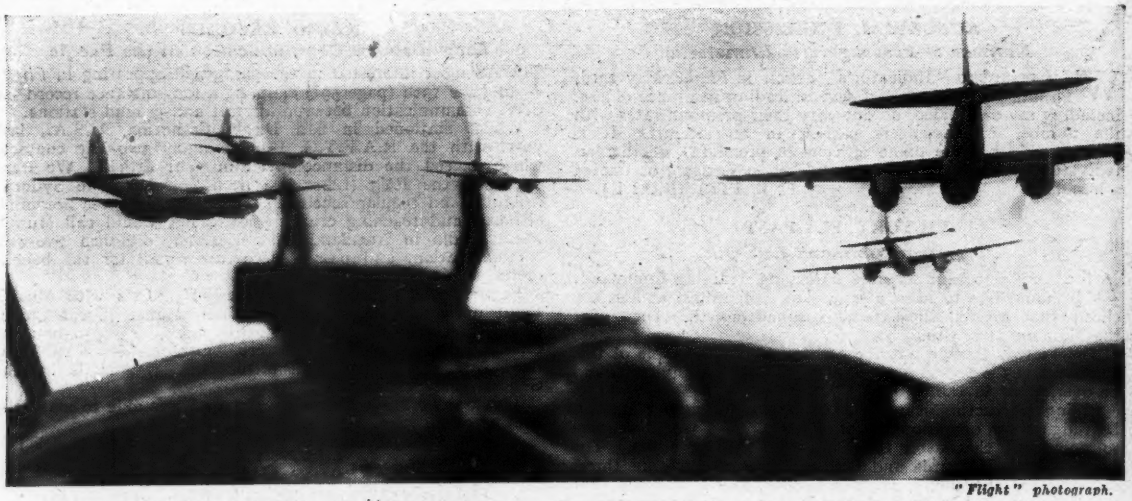
Like many other ex-apprentices, we had the misfortune to pass out of Halton in the early years of the war. Because of that, none of us had even the chance of entering the R.A.F. College at Cranwell, thereby securing that coveted prize—a permanent commission, together with the flying and engineering instruction which a course at the college has to offer.

Many of us attempted to become "flying types" during the war, but, owing to the fact that to be a Group I tradesman was an almost certain barrier to that ambition, few of us had our hopes realized. Engineering commissions, too, were treated with a good deal of suspicion, for a reason already given by one correspondent—namely, that at the end of hostilities we were very likely to be discharged from the Service.

So now that the R.A.F. College is to be opened once more, cannot the age limit for entry be raised to enable those of us who were denied the opportunity during the war and who already have the other necessary qualifications, to have a chance of gaining admittance? It is a step which would be warmly welcomed by members of wartime entries at Halton who have a desire to reach the higher ranks in the Service, and, more important still, perhaps, the security given by a permanent commission to enable them to remain there.

Malta. "TWO EX-BRAT SERGEANTS."

SERVICE AVIATION



"Flight" photograph.

THROUGH THE WINDSCREEN: This unusual view shows Mosquito VIs of No. 4 Squadron in formation. Our photograph was taken from the navigator's position in one of the formating Mosquitoes.

Royal Air Force and Naval Air Arm News and Announcements

Extended Service for N.C.O. Aircrew

THE Air Ministry announces that arrangements have been made for a substantial number of serving non-commissioned aircrew to extend their period of service by three years' regular service, followed by four years on the reserve.

Men accepted for the extended service will receive, on signing on, a sum of £25, and on transferring to the reserve those who were sergeants on January 1st last will receive a gratuity of £125, those who were flight sergeants £150, and warrant officers £175.

The Cosford Club

UNDER the above title, a new club has been formed for A.T.C. officers and members of civilian committees.

The President of the club is Air Chief Marshal Sir Robert Brooke-Popham; Air Marshal Sir Leslie Gossage, Air Vice-Marshal Sir Alan Lees, and Sir W. W. Wakefield are Vice-presidents.

Sqn. Ldr. C. R. Humphries, the former Commanding Officer at Cosford, where many thousands of A.T.C. officers attended training courses, is Hon. Secretary of the club; Mr. S. J. Noel-Brown is the present Chairman of the Committee.

Accommodation has been arranged, in conjunction with the Chesterfield Officers' Club, at 8, Chesterfield Gardens, W.1. At a later date, the club hopes to arrange for flying facilities, with instruction in elementary flying and gliding.

Temporary offices have been provided by the Chairman at 2, Lord North Street, Westminster.

Rescue Launches Leave Malta

WHEN the Fairmile long-range rescue craft of No. 204 A.S.R. Unit left Malta recently for Egypt, they closed a highly successful, but little-publicised, chapter in Royal Air Force air-sea rescue history.

During the war more than 2,000 "ditched" Allied aircrew personnel were rescued from the Mediterranean by the Rescue Service at Malta. No. 204 A.S.R.U., then equipped with H.S.L.107 launches, claims 700 of this total.

Air-sea rescue in the area is now maintained solely by aircraft.

Naval Presentation

ON June 14th the Chairman and Committee of Lloyds received from the Captain of H.M.S. *Implacable* a beautifully finished scale model of the carrier, made by officers and men of the ship in their spare time.

H.M.S. *Implacable* was adopted by Lloyds in 1942. Recreational equipment, library books and many other gifts to improve conditions on board have been provided by Lloyds, and while the carrier was with the Pacific Fleet the ship's company received much hospitality from the Australian branch of the company at Sydney.

Appointments

THE Air Ministry announces two new appointments: Air Vice-Marshal H. S. P. Walmsley, C.B., C.B.E., M.C., D.F.C., to be Air Officer in Charge of Administration, Air H.Q., India.

Air Vice-Marshal A. L. Paxton, C.B.E., D.F.C., to be Air Officer Commanding, No. 2 Group, B.A.F.O. (Germany).

Awards

Royal Air Force

THE KING has been graciously pleased to approve the following awards:—

Distinguished Service Order

Act. Wing Cdr. T. S. TULL, O.B.E., R.A.F.V.R.—As a member of No. 5 Repatriated Allied Prisoners of War and Internees contact team, Wing Cdr. Tull parachuted into Java in September, 1945. Before the arrival of British troops he made contact with many R.A.P.W.I. camps and, on his own initiative, organized their well-being and arranged hospitals for the sick. This was done at considerable risk to his life from the suspicious and unfriendly population. Later on, when disturbances broke out, he organized the recapture of Semarang, thus saving hundreds of R.A.P.W.I. lives. Shortly after the arrival of British troops, Wing Cdr. Tull, whilst in Ambarawa which held 9,000 R.A.P.W.I., arranged for the reception of 2,000 more from Magelang when fighting broke out there. Ambarawa was then besieged and the R.A.P.W.I. camps were frequently under shell fire. Wing Cdr. Tull, however, went about his duties quite regardless of his own safety, visiting the shelled areas and inspiring the many women and children with confidence and hope. His courage, endurance and steadfastness over a long and trying period have been beyond all praise.

Act. Wing Cdr. B. R. MACNAMARA, R.A.F., No. 31 Sqn.—Wing Cdr. MacNamara commands the sole remaining Close Support Transport Squadron actively engaged in operations. He served in a similar capacity with squadrons supporting the Fourteenth Army during the Burma campaign. Flying on a large proportion of sorties himself, he has set a high standard of leadership in the air. Throughout the difficult operations in the Netherlands East Indies, this officer has displayed outstanding administrative ability and devotion to duty.

Bar to Distinguished Flying Cross

Flt. Lt. J. P. CUTHBERT, D.F.C., R.A.F.V.R., No. 117 Sqn.

Capt. A. E. SISSING, D.F.C., S.A.A.F., No. 34 (S.A.A.F.) Sqn.

Distinguished Flying Cross

Sqn. Ldr. A. M. RUSTON, R.A.F., No. 240 Sqn.

Act. Sqn. Ldr. A. R. BEDDOW, R.A.F., No. 233 Sqn.

Act. Sqn. Ldr. L. A. THOROGOOD, R.A.F.V.R., No. 155 Sqn.

Flt. Lt. C. K. COLE, R.A.F.V.R., No. 221 Communication Sqn.

Flt. Lt. I. FORBES, R.A.F.V.R., No. 132 Sqn.

Flt. Lt. W. G. LAMBERD, R.A.F.V.R., No. 132 Sqn.

Flt. Lt. B. G. L. O'REILLY, R.A.F., No. 117 Sqn.

Flt. Lt. S. A. PAIGE, R.A.F., No. 267 Sqn.

Flt. Lt. P. RATHIE, R.A.F.V.R., No. 261 Sqn.

Act. Flt. Lt. R. S. TRIGG, R.A.F.V.R., R.A.F. Airborne Control Unit.

F/O. T. W. HUMPHREYS, R.A.F.V.R., No. 117 Sqn.

Flt. Lt. J. J. GREENE, R.C.A.F., No. 406 (R.C.A.F.) Sqn.

Flt. Lt. R. H. HUNTER, R.C.A.F., No. 28 Sqn.

Lt. D. GUNN, S.A.A.F., No. 34 (S.A.A.F.) Sqn.

Lt. E. E. B. PATTERSON, S.A.A.F., No. 34 (S.A.A.F.) Sqn.

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Grade	EF	LA	LF
Base	Asbestos Non-woven	Asbestos Cloth Heavy Weave	Asbestos Cloth Fine Weave
Tensile Strength (lb./sq. in.)	27,000	7,000	12,000
Compressive Strength (lb./sq. in.)	65,000	34,000	42,000
Shear Strength (lb./sq. in.)	18,000	11,000	15,000
Cross-breaking St'gth (lb./sq. in.)	29,000	14,000	19,000
Impact Strength (ft./lb.)	5	2.5	4
Fatigue Strength (tons/sq. in.)	3.75	1.0	2.25
Density (Gm./c.c.)	1.87	1.67	1.74

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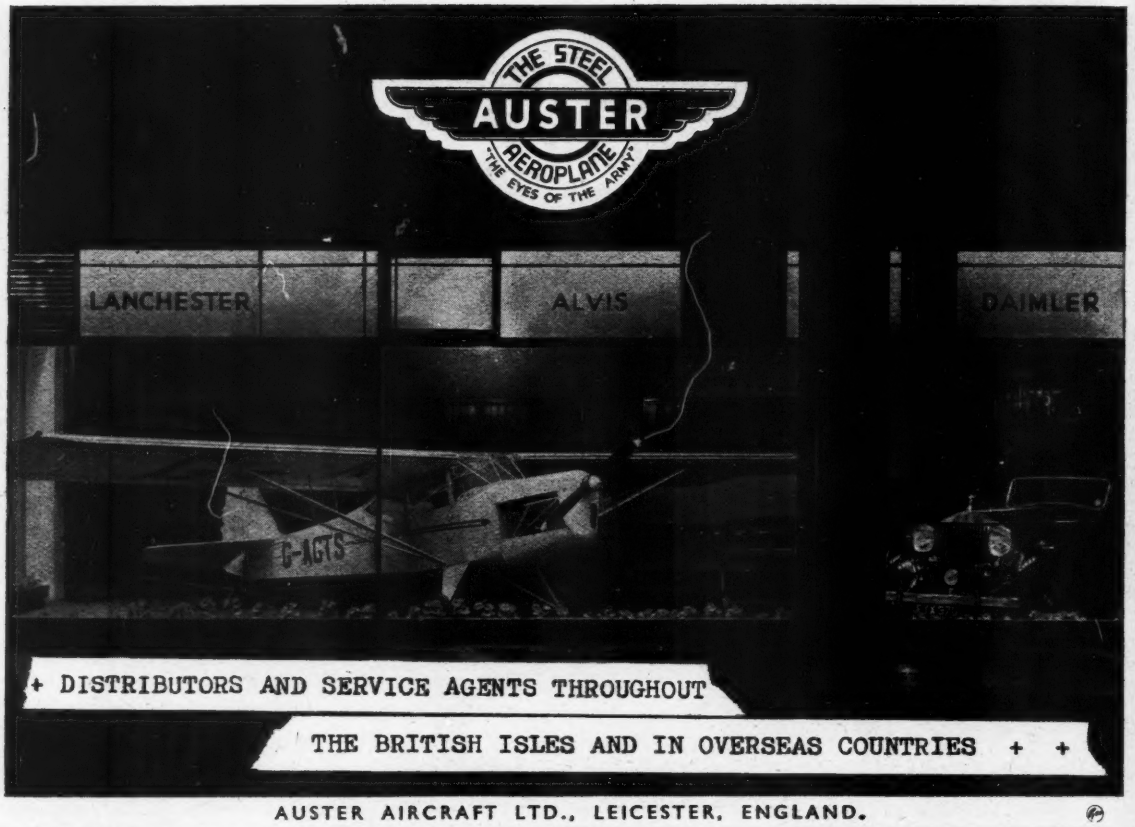

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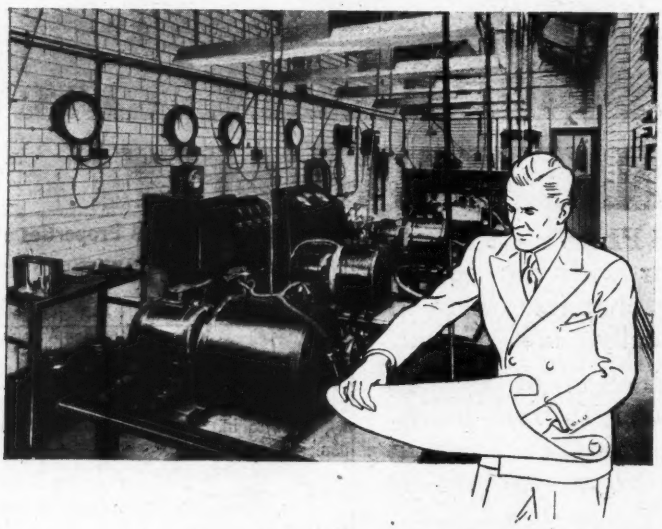

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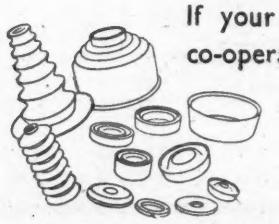

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SUPERFECT

SERVICE AVIATION

Distinguished Flying Medal

Flt. Sgt. T. W. GALLIFORD, R.A.F., No. 209 Sqn.

R.N.Z.A.F.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in execution of air operations in the South West Pacific.

Distinguished Flying Cross

Sqn. Ldr. G. S. A. STEVENSON, R.N.Z.A.F.
Act. Sqn. Ldr. W. A. HARDMAN, R.N.Z.A.F.
Flt. Lt. H. R. DEAN, R.N.Z.A.F.
Flt. Lt. A. G. PIERARD, R.N.Z.A.F.
Flt. Lt. J. L. SCOTT, R.N.Z.A.F.
Act. Flt. Lt. R. A. MARTIN, R.N.Z.A.F.
F/O. D. W. GRINDELL, R.N.Z.A.F.
W/O. H. B. NEWELL, R.N.Z.A.F.

This photograph, taken at a recent investiture at the U.S. Embassy in London, shows Wing. Cdr. C. Merrick receiving the Bronze Star Medal. It was awarded for "meritorious service in planning glider operations."

Roll of Honour

Casualty Communiqué No. 589.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 299 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sqn. Ldr. J. T. Wilkins.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. K. Holden.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. A. C. Adams; P/O. R. B. T. Adams; Sgt. K. C. R. Alder; Flt. Sgt. W. H. Aldercotte; Sgt. J. R. Alves; F/O. D. S. Angier; F/O. G. D. Askew; Act. Sqn. Ldr. A. H. Baird, D.F.C.; Sgt. A. Balloch; Flt. Sgt. A. F. Barratt; Flt. Lt. R. W. Bartlett; Flt. Sgt. H. T. Batten; Sgt. J. T. Beardmore; Sgt. E. E. Bemrose; Flt. Sgt. R. S. Bennett; P/O. W. G. Bennett; Flt. Sgt. K. J. A. Bicknell; Flt. Sgt. J. C. R. Bignell; P/O. L. F. Bonnet; Flt. Lt. G. H. Borham; Sgt. H. Bowden; Sgt. S. J. Bowden; Flt. Sgt. R. W. Brett; Flt. Sgt. S. Brockbank; Sgt. G. S. Brown; Sgt. J. B. F. Brown; Sgt. J. G. Brown; Flt. Sgt. P. G. Buckland; Act. Flt. Lt. J. Buning; Flt. Lt. N. Burrows; Sgt. D. H. Burton; W/O. C. C. Cæsar; Sgt. R. P. Candy; Sgt. R. J. Carrott; Sgt. S. S. Carter; F/O. H. N. Cheeseman; Sgt. K. G. Cheshire; P/O. E. M. Chetwynd-Stapylton; Sgt. G. Cole; Flt. Lt. N. S. C. Colley; Sgt. L. F. Connell; Sgt. H. Connor; F/O. E. J. Cooper; Flt. Sgt. P. S. Cooper; W/O. B. J. Corkery; Act. Flt. Lt. P. B. Cornwallis; Sgt. J. E. Cory; Sgt. T. F. Creedy; Flt. Sgt. L. B. Crook; Sgt. D. McB. Crowe; Flt. Lt. R. S. Cumming; Act. Flt. Lt. R. Cunliffe; F/O. K. L. Cutts; F/O. B. O. Davis; Sgt. E. R. Davis; P/O. L. F. Davis; Sgt. P. Day; Sgt. T. H. Deere; Sgt. J. A. Doherty; Flt. Lt. R. A. A. Doherty, D.F.C.; F/O. S. Downes; Sgt. C. S. Drake; P/O. C. G. Draper; Flt. Sgt. J. Duncan; Flt. Sgt. A. Edwards; Sgt. V. A. Edwards; Sgt. N. S. Evans; Sgt. R. Evans; Sgt. J. Finlayson; F/O. D. P. M. Finnigan; Flt. Lt. R. H. Fossett, A.F.C.; Sgt. W. A. Frost; F/O. W. P. Fryer; Sgt. T. H. Fullwood; Sgt. W. G. Gedge; Sgt. D. B. George; P/O. W. J. Gibbs; F/O. D. S. Gladstone; Sgt. M. J. F. P. Goddard; F/O. L. J. Gornall, D.F.C.; P/O. J. G. Gower; Sgt. K. G. Greathead; Flt. Sgt. G. J. A. Groom; Flt. Sgt. J. H. Gubbins; F/O. A. Hanson; Sgt. B. R. Hasler; Sgt. T. H. Hatton; Flt. Sgt. J. Hawkridge; Sgt. D. W. Hayes; Flt. Sgt. R. E. Hayward; Flt. Sgt. F. H. Heron; Sgt. S. W. Herring; F/O. A. T. Hewett; Sgt. W. Hewson; Sgt. D. G. Howdle; Sgt. M. M. Howe; F/O. H. H. Hopkin; F/O. R. W. Horrocks; Sgt. G. A. Hubbard; F/O. R. A. Hudson; Flt. Sgt. W. Irwin; Flt. Sgt. R. J. H. Jackson; Sgt. G. R. James; Sgt. E. C. Jarvis; F/O. W. J. Jenkins; Sgt. J. Johnston; Sgt. F. W. Jones; Flt. Sgt. H. Jones; Sgt. P. R. Jones; P/O. R. E. Jones; Flt. Sgt. R. Kear; Flt. Sgt. F. Kendall; Sgt. D. F. Kirby; Flt. Sgt. H. J. Knightbridge; Flt. Sgt. R. A. Lane; Sgt. H. G. Lawley; Flt. Sgt. E. F. Lea; F/O. K. C. S. Legge; Flt. Sgt. R. L. Lewis; Flt. Sgt. H. T. Little; Act. Flt. Lt. J. K. Livingstone, D.F.C.; Flt. Sgt. J. E. Lomas; F/O. E. J. Lowther; Sgt. J. McAfee; Sgt. J. P. McEvoy; Sgt. E. Mackenzie; Sgt. K. McKirgan; P/O. W. R. D. MacLeod; Sgt. R. McRae; Flt. Sgt. J. Mace; Sgt. J. Mallabone; Sgt. R. Marriott; F/O. J. A. Masheder; Sgt. F. Meekison; Flt. Lt. H. K. Mepham; Sgt. T. Miller; Sgt. R. D. Mitcheson; Flt. Sgt. J. Montague; F/O. L. Moore; Flt. Sgt. E. Morris; F/O. G. D. Morrison; F/O. E. J. Mortis; Flt. Sgt. H. G. Newbery; Flt. Sgt. L. L. Nicholas; Flt. Sgt. R. E. Nicholas; P/O. F. T. J. Nicholls; Sgt. T. O'Gorman; Sgt. O. O'Rourke; Sgt. T. Orr; F/O. D. H. Over; F/O. R. J. Owen; Flt. Sgt. E. Parkinson; Sgt. W. Pass; Flt. Sgt. R. Patterson; P/O. S. A. Pepworth, D.F.M.; Sgt. J. M. Pickering; Sgt. J. H. Pinsent; Sgt. A. S. Pitt; Sgt. H. W. Porter; F/O. K. S. Porter; Flt. Lt. F. W. Price; Flt. Sgt. J. R. A. Ramsay; F/O. J. F. A. Rayns; Flt. Sgt. E. A. Rex; P/O. J. S. Rice; W/O. J. M. Roberts; Sgt. J. Robertson; Sgt. B. Robinson; Flt. Sgt. C. A. Robinson; Sgt. T. A. Rodgers; Flt. Sgt. D. G. Rodwell; Sgt. S. Rosenthal; F/O. C. F. Royds; Sgt. W. A. Salisbury; Sgt. W. J. R. Scott; Flt. Sgt. L. F. F. Scull; Sgt. R. Shackleton; Sgt. N. E. A. Sharpe; Sgt. C. W. Sibley; Sgt. D. S. Sidhu; Sgt. M. Sills; Flt. Sgt. A. G. Simmons; Flt. Sgt. E. W. Sinkinson; Flt. Lt. D. A. Smart; Flt. Sgt. A. E. Smith; Flt. Sgt. J. W. Stazaker; Sgt. W. Stephens; Flt. Sgt. A. C. St. Leger; Flt. Sgt. G. Summers; Sgt. H. A. Sumner; Sgt. J. Swain; Sgt. A. J. Taylor; F/O. G. Thirlwell; Sgt. H. M. Thomas; P/O. J. S. Thompson; F/O. K. R. Thompson; Sgt. L. G. Thompson; Flt. Sgt. C. R. Tibbo; Flt. Sgt. F. T. Tong; P/O. S. A. W. Tresidder; Flt. Sgt. L. Trowsdale; Sgt. H. A. Tuck; Sgt. E. A. E. Tucker; Flt. Sgt. P. Turner; Flt. Sgt. A. E. Tyreman; Sgt. T. W. H. Usher; Sgt. H. J. Vidamour; Sgt. C. J. Walden; Sgt. H. E. Ward; Flt. Sgt. D. W. Webb; Sgt. E. W. Webb; Flt. Sgt. W. C. Webley; Sgt F. W. Webster; Sgt. N. D. Webster; Flt. Sgt. R. Wellington; Flt. Sgt. E. Wheeler; Sgt. W. L. Whitehead; Flt. Sgt. A. C. Widdowson; Sgt. C. Wilkins; Sgt. D. Williams; Flt. Sgt. I. Williams; W/O. F. S. Wilsher; Sgt. B. F. Woods; Act. F/O. B. Yates; Flt. Sgt. E. P. Yates; F/O. A. MacD. Young; Sgt. J. Young; F/O. H. R. J. Young.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. J. L. Beard; Sgt. J. Nichol; Flt. Lt. E. G. Parsons; Flt. Sgt. W. Phinn; Flt. Sgt. E. Ramsay.

KILLED ON ACTIVE SERVICE.—L.A/C. R. F. Chesson; Act. Cpl. A. B. Eve; A/C.2 H. A. Jeffrey; P/O. G. Rutherford; F/O. E. Tongue.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. A. Allen; Sgt. C. Chapman; Cpl. D. L. Dickenson; A/C.1 J. V. Fawcett; A/C.1 D. N. Gealy; A/C.1 A. J. Weare.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. T. E. Anthony; Sgt. G. Arnold; Sgt. G. Banks; Sgt. D. H. Clayton; Sgt. L. Cornbloom; Sgt. R. C. Harris; Sgt. D. A. Jordan; W/O. J. W. McStay; Flt. Sgt. K. J. Molloy.

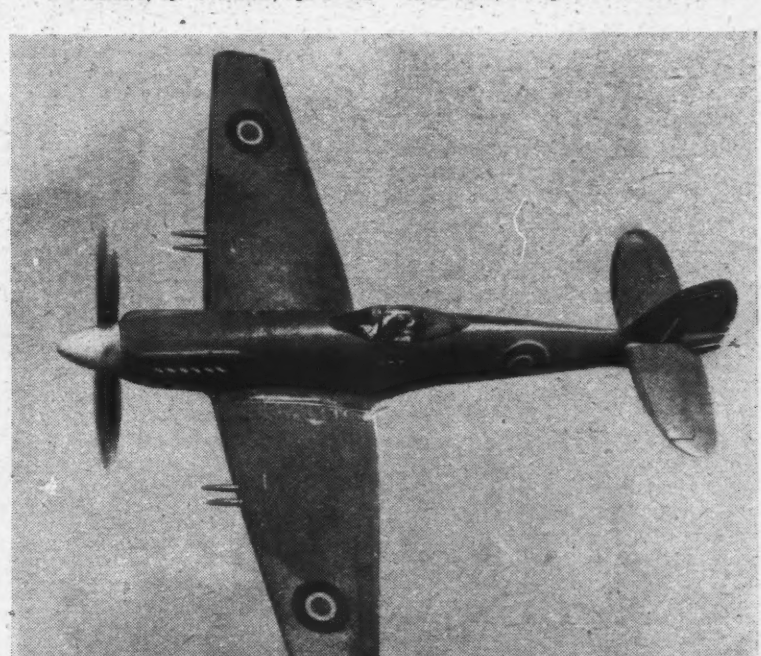
DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.2 J. P. Hadrill; A/C.1 A. Titley; L.A/C. W. K. Vass.

DIED ON ACTIVE SERVICE.—A/C.1 A. L. Curtis; L.A/C. M. Dobson; A/C.2 G. W. Docherty; A/C.2 H. Flint; A/C.1 W. N. Floyd; L.A/C. E. P. Gavigan; Cpl. J. S. Gerrard; A/C.2 W. F. Green; L.A/C. P. W. Greenfield; A/C.1 H. Greenwood; Cpl. C. L. Harris; L.A/C. J. R. House; Sgt. G. L. Howorth; Act. Cpl. J. A. Jakes; L.A/C. F. L. McKinlay; L.A/C. F. P. Mason; A/C.2 F. A. E. Marshall; L.A/C. J. Marshall; Cpl. H. E. Mathews; L.A/C. M. Nash; L.A/C. T. A. Nash; A/C.1 R. T. Nunn; A/C.2 H. Nutter; A/C.2 H. W. J. Parker; A/C.1 H. T. Penfold; L.A/C. C. F. Perry; L.A/C. A. E. Pigott; A/C.1 W. E. Pollock; A/C.2 B. Reeves; A/C.2 C. Reeves; A/C.1 A. Riley; L.A/C. G. F. Rogers; A/C.1 A. A. Saunders; A/C.1 A. W. Shickle; L.A/C. R. A. Skea; A/C.1 G. H. R. Slater; L.A/C. J. Spence; L.A/C. F. I. Spencer; A/C.2 T. L. D. Springate; A/C.1 H. G. Thomas; A/C.1 R. J. Thomas; A/C.2 G. E. Thompson; A/C.1 J. McL. Urie; Sgt. R. E. L. Venning; W/O. L. Walters; A/C.1 H. E. Warne; A/C.1 C. Waterhouse; L.A/C. E. W. Wells; L.A/C. P. Whiston; Cpl. A. R. Whymark; A/C.2 A. E. Williams.

Royal Australian Air Force

KILLED IN ACTION.—P/O. W. Chisholm.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. K. E. H. Bennett; Flt. Lt. K. C. Beruldsen; P/O. J. Binstead; Flt. Sgt. F. A. Black; Flt. Sgt. R. C. Brookman; Flt. Sgt. W. F. Bull; P/O. W. F. Burcher; P/O. R. W. Byrnes; Flt. Sgt. W. J. Carpenter; Flt. Sgt. R. S. Chandler; Flt. Sgt. R. G. Cornwell; W/O. R. G. D. Dillon; F/O. J. R. Donald; Flt. Sgt. H. M. Earle; P/O. A. F. Emery; Flt. Sgt. E. C. Fagg; Act. F/O. M. J. Feddersen; Flt. Sgt. L. W. Flohm; F/O. M. A. Flory; Flt. Sgt. R. H. Gawler; F/O. W. A. Greenshields; Flt. Sgt. W. Herbertson; Flt. Sgt. F. M. Herne; Flt. Sgt. W. L. Houston; P/O. H. J. Hutcheson; W/O. D. W. Jones; Flt. Sgt. M. A. Jones; Flt. Sgt. R. C. Klezel; F/O. W. J.



SWIFT AND SLEEK: This near-plan view of the Seafang emphasises the slim purposefulness of its lines. Although the prototype has a five-bladed airscrew, production machines will possibly be fitted with "contra-props" for carrier operations.

"Flight" photograph.

SERVICE AVIATION

Little; Flt. Sgt. P. M. Low; Flt. Sgt. N. F. D. McGladrigan; P/O. R. F. McMaster; F/O. J. H. McNamara; Flt. Sgt. C. E. Mengel; Flt. Sgt. V. H. Minchin; W/O. R. L. Morris; Act. F/O. J. G. Ogilvie; Flt. Sgt. G. G. Olsen; F/O. W. G. Ottaway; P/O. H. J. Pearmain; F/O. F. J. Pettiford; Act. F/O. E. B. Rowell; Flt. Sgt. R. H. Royes; F/O. G. F. Sinden; Flt. Sgt. A. S. Smith; Flt. Sgt. M. R. Stedman; F/O. K. R. Stewart; Flt. Sgt. D. J. Taylor; F/O. K. Watts; Act. F/O. R. R. Wonders.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—W/O. J. Johnson; Flt. Sgt. W. A. Taylor.

KILLED ON ACTIVE SERVICE.—Sgt. N. S. Geappen.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—F/O. R. J. O'Sullivan.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Sgt. B. Appleby.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. F. Blank; W/O. R. J. Graham

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. A. G. Hill.

Casualty Communiqué No. 590.

Of the names in this list 297 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. N. A. Burrows; Sgt. L. B. Towson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. H. C. Locke.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. E. C. Allison; Sgt. G. H. Armstrong; Sgt. G. Askey; Flt. Sgt. C. R. Badger; F/O. W. J. Bailey; Flt. Lt. A. Baker; W/O. R. J. Ball; Flt. Sgt. E. C. Bangs; Act. Flt. Lt. D. G. Bates; F/O. C. W. Baush; Flt. Sgt. H. Bedford; Act. Wing Cdr. E. A. Benjamin, D.F.C; Flt. Sgt. T. J. Bicknell; Flt. Lt. K. R. Bingham, D.F.C.; Flt. Sgt. W. N. Birkett; Act. Sqn. Ldr. R. A. Boddington, D.F.C.; Flt. Sgt. G. E. Bolland, D.F.M.; P/O. T. O. Bolton; Flt. Sgt. N. Bott; Flt. Sgt. H. Botterill, D.F.M.; Flt. Sgt. A. L. Bragg; Sgt. R. Breaks; Flt. Sgt. C. J. Bridgett; Act. Flt. Lt. E. G. Brown; Flt. Sgt. R. H. Brown; Sgt. H. Burrows; Flt. Sgt. H. J. Burton; Sgt. M. A. Callaghan; Sgt. F. J. Carolan; Flt. Sgt. T. S. Carr; Sgt. G. A. Carson; Sgt. J. Cartmell; Sgt. H. Castle; F/O. A. W. Clark; F/O P. C. H. Clark; Sgt. G. A. Clarke; Flt. Lt. F. G. Cliffe; Sgt. W. Clyde; Flt. Sgt. N. Cooper; Flt. Sgt. F. W. Cotton; Act. Flt Lt. J. D. F. Cowden, D.F.C.; Act. Flt. Lt. J. F. Craik, D.F.C.; P/O. F. A. Cresswell; W/O. F. W. Cuthbertson; Flt. Lt. J. S. Davidson; Sgt. H. G. Davies; Sgt. J. Davies; Flt. Lt. J. O. Davies; Flt. Sgt. W. F. G. Dawson; Sgt. W. T. Dean; F/O. S. Denmark; Sgt. G. Diffey; Sgt. J. Dixon; F/O. J. R. C. Donohue; F/O. R. W. Donner; F/O. P. B. Doran; F/O. W. Dron; W/O. J. Dugdale; Sgt. T. N. Dunlop; Sgt. L. W. Dunn; Sgt K. G. Durston; Sgt. S. W. Ede; Sgt. R. F. Edwards; F/O. T. O. E. Ellis; Sgt. G. E. Emerson; Flt. Sgt. J. R. Ennor; Sgt. D. Evans; Flt. Sgt. E. L. Evans; Flt. Sgt. B. Edwards; Sgt. J. G. Evans; Sgt. J. L. Fallows; Act. Flt. Sgt. J. R. Farrow; Flt. Sgt. V. E. Filaratoff; Sgt. E. Finch; P/O. D. D. Finlayson; Flt. Sgt. J. K. Finlayson; W/O. A. G. Flack; Sgt. F. R. Flesch; W/O. D. Forbes; P/O. J. G. Forsyth; Sgt. G. V. Foyle; Flt. Sgt. J. G. Fraser; Flt. Sgt. J. M. Freeman; F/O. A. Frost; F/O. W. Gabbott, D.F.M.; Act. Flt. Lt. S. R. Galloway; Sgt. T. W. Gascoigne; Flt. Sgt. J. P. Gascoyne; F/O. T. A. Gill; Sgt. A. K. Goodall; Sgt. G. R. Grimsdell; Flt. Sgt. R. T. C. Guscott; Sgt. J. D. Hall; Sgt. W. M. Haragan; Sgt. H. W. J. Hardy; Flt. Sgt. B. W. Harris; Sgt. E. Harrison; F/O. J. E. Heath; Sgt. T. Helstrip; F/O. N. P. Hibbert; Sgt. E. G. Hick; Flt. Sgt. W. L. Hilder; F/O. P. C. Hill; F/O. R. C. Hill; Sgt. W. J. K. Holland; Sgt E. M. Holliday; Sgt. J. Holloway; P/O. G. Holmes; P/O. W. Hooper; Flt. Sgt. E. G. Hopkins; Sgt. W. J. Hosking; Sgt. J. Howard; Flt. Lt. G. B. Howson; P/O. A. M. B. Hughes; Sgt. D. W. Hughes; Sgt. J. Hughes; F/O. E. G. Hull; Sgt. M. J. Husband; Flt. Lt. R. D. Jeff; Flt. Sgt. W. E. A. Jeffery; Flt. Sgt. E. E. Jenkins; Flt. Sgt. D. B. Jones; Sgt. J. K. Jones; Flt. Sgt. J. T. Jones; W/O. D. K. Jordan; Sgt. W. S. Keenleyside; Flt. Sgt. J. L. Kerr; F/O. G. W. A. Kidd; Flt. Sgt. H. F. King; Sgt. M. F. Kingdom; F/O. G. Langmead; Flt. Sgt. F. W. Lee; F/O. J. B. Leslie; Sgt. H. Lewis; Flt. Sgt. B. Longworth; F/O. H. L. Lucas; Flt. Sgt. A. J. MacDonald; F/O. J. P. MacWilliams; Flt. Sgt. J. McCreadie; Sgt. A. Martin; Flt. Sgt. E. J. Maslin; Sgt. D. K. W. Mayes; Sgt. W. B. Meechan; F/O. G. E. Mercer; F/O. R. L. Middlemas, D.F.C.; Flt. Lt. H. E. Miller; Sgt. R. Monk; Sgt. J. F. A. Mooney; F/O. F. C. Morgan; Flt. Sgt. D. Moroney; F/O. E. J. S. Morris; Sgt. J. Murphy; Flt. Sgt. J. M. Murray; Sgt. N. W. Oates; F/O. M. A. O'Callaghan; Flt. Sgt. L. A. Page; Flt. Sgt. C. W. Palmer; Sgt. F. Parkins; P/O. P. J. Parsons; F/O. T. Pawsey; Sgt. H. Peach; Act. W/O. F. J. Poole, D.F.M.; Sgt. L. A. Pople; Flt. Sgt. W. R. Powell; Sgt. W. Pratt; Sgt. E. F. Price; Sgt. S. J. Price; Flt. Sgt. J. A. Quick; Sgt. A. R. Quinton; Flt. Sgt. L. Randall; Act. Flt. Lt. J. Ray; Flt. Sgt. J. W. Richards; Sgt. B. C. Ricketts; Act. Flt. Lt. F. H. Ridgewell; Sgt. D. Robinson; F/O. D. Rodger; Sgt. G. E. Rolls; Flt. Sgt. R. Rome; F/O. R. J. Rowe; Sgt. R. E. Russell; Sgt. R. N. Seager; Sgt. H. P. C. Seignot; Flt. Sgt. J. G. Shaw; Sgt. W. Simpson; Sgt. J. M. Sinclair; F/O. D. F. Sinfield, D.F.C.; P/O. H. E. Slingsby; Flt. Sgt. R. W. H. Smith; Flt. Sgt. G. D. Stean; Flt. Sgt. J. L. Stone; Act. F/O. A. C. Strachan; Flt. Sgt. W. S. H. Strong, D.F.M.; Flt. Lt. P. Sutehall; Flt. Sgt. V. J. Sutherland; Flt. Sgt. G. L. Tabor; Flt. Lt. J. H. Taylor; Flt. Sgt. J. E. Thompson; W/O. R. Thomson; P/O. P. Thorne; Flt. Sgt. G. C. Toes; Sgt. F. W. Underhill; W/O. A. T. Wainwright; Sgt. F. W. Wakefield; Sgt. W. Walker; Sgt. J. Ward; Sgt. A. M. Watson; Flt. Sgt. J. R. Weaver; F/O. D. G. Webb; F/O. E. Webb; Flt. Sgt. J. Webber; P/O. S. T. Wells; Sgt. H. C. Whaites; P/O. K. F. White; Sgt. B. Whitfield; Flt. Sgt. D. S. Whitehouse; Sgt. E. C. Wilkie; F/O. D. E. G. Williams; Sgt. H. R. Williams; Flt. Sgt. D. Wood; Sgt. D. F. Wood; W/O. M. Woodthorpe; Sgt. F. E. Wright.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Lt. J. B. Gordon.

MISSING.—Flt. Sgt. D. Anderson; Flt. Sgt. C. E. F. Blake; Flt. Sgt T. K. Clucas; W/O. E. B. Holloway; F/O. J. K. Houle; Flt. Sgt. E. E. W. King; Sgt. D. C. MacLean; Sgt. S. H. Mortimer; L.A/C. J. Parker; F/O. K. Parmenter, D.F.M.; L.A/C. R. Price; W/O. K. W. Robinson; Flt. Sgt. R. W. Vickers; Flt. Sgt. J. W. Wilson.

KILLED ON ACTIVE SERVICE.—F/O. W. D. McGregor.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. Davidson; Sgt. A. G. R. McFarlane; Sgt. J. Mackie; Sgt. J. E. Ralph; Sgt. R. H. H. Side; Sgt. E. Smails; Sgt. C. W. Woods; Sgt. T. R. W. Vincent; Sgt. T. S. McLoughlin; Sgt. R. K. M. Lewis.

DIED ON ACTIVE SERVICE.—A/C.2 A. F. Atkinson; L.A/C. R. P. Aymsley; A/C.1 N. J. Brackenbury; A/C.1 C. Bradley; A/C.1 G. E. Bradley; Flt. Sgt. W. Burns; Sgt. D. H. Comer; A/C.1 R. A. Goodall; A/C.1 W. H. Haldane; A/C.1 R. B. W. Hewson; Cpl. G. W. Hill; A/C.1 J. Holland; Sgt. F. B. Howcroft; L.A/C. H. Jefferies; Sgt. H. G. Jones; Act. Cpl. N. G. Jones; A/C.1 O. Jones; L.A/C. E. C. Laker; Cpl. R. S. Leonard; Cpl. A. E. Ling; L.A/C. W. McQuade; L.A/C. L. J. Masters; L.A/C. W. S. Northwood; A/C.1 L. Oldcorn; Act. Cpt. S. E. Peet; Cpl. C. Saunders; A/C.2 W. M. Scammell; Cpl. H. Scoon; A/C.1 G. Scott; A/C.1 G. H. Scudder; A/C.1 W. A. Searle; Cpl. F. T. Solly; Cpl. J. F. Stenhoff; Flt. Sgt. R. Thompson; L.A/C. J. P. Thomson; W/O. D. A. Wolfe; A/C.2 P. H. Wood; Flt. Sgt. N. Woodward; Flt. Sgt. E. C. Wright.

Badge of No. 12 Operational Training Unit, Royal Air Force—"Prepare for Battle."

Badge of No. 85 Operational Training Unit, Royal Air Force—"Strong to Endure."

Women's Auxiliary Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/CW. M. H. Elwell.

Royal Australian Air Force

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Royal Canadian Air Force

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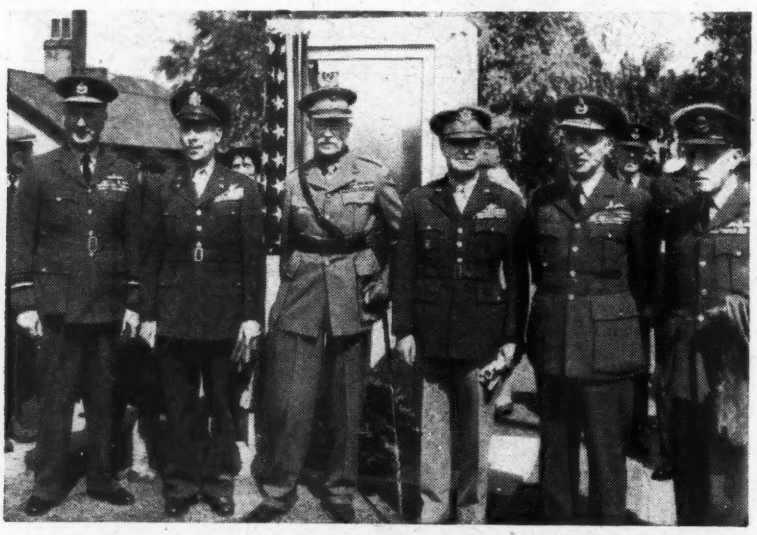

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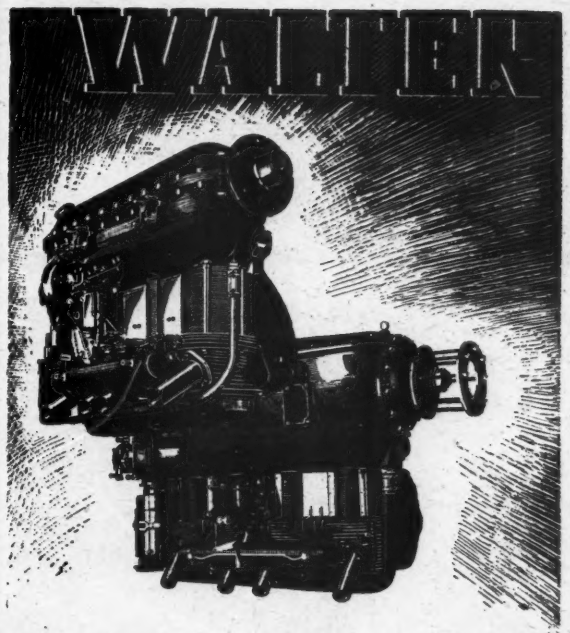

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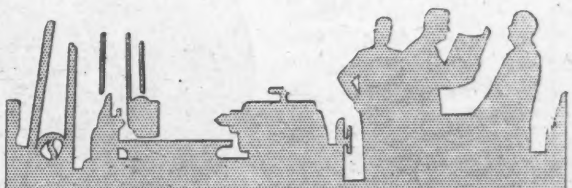

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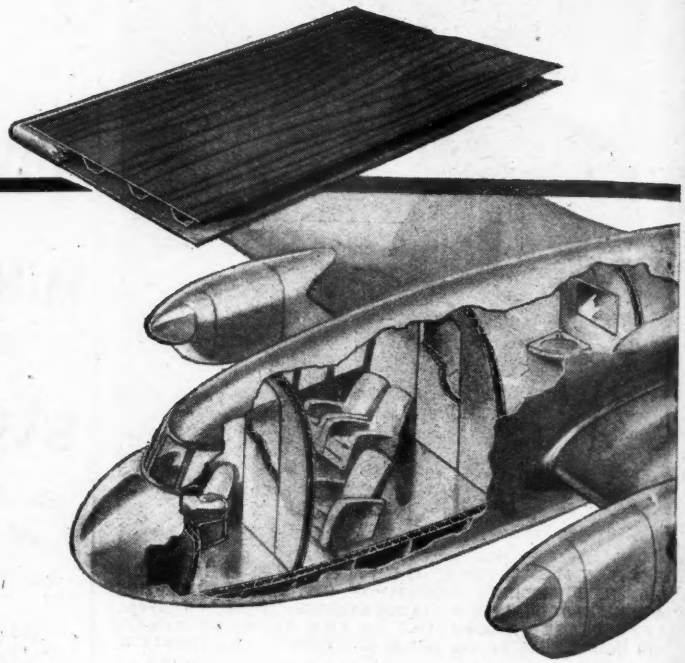

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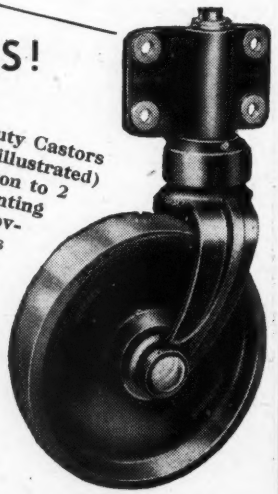

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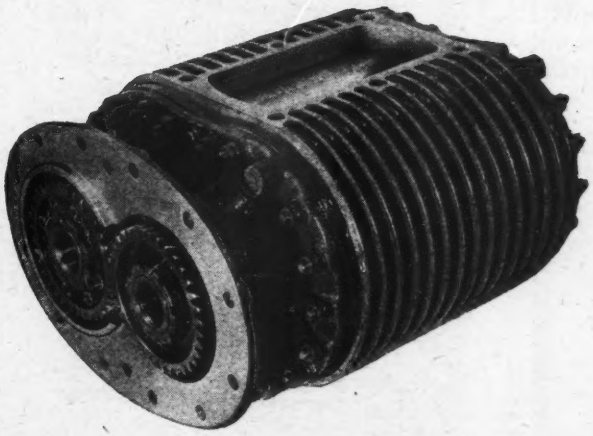

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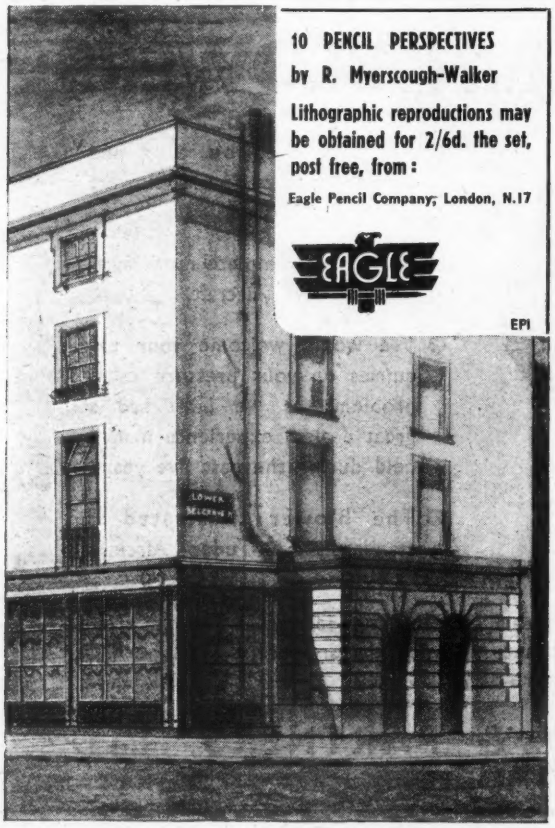

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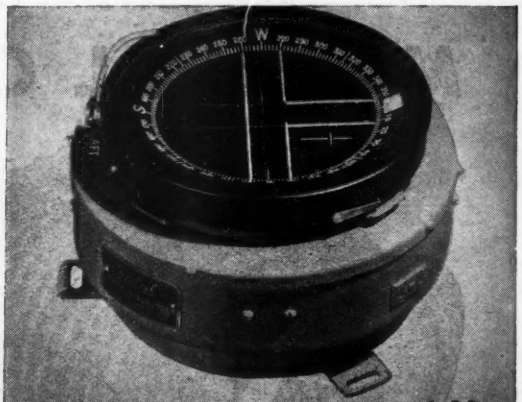

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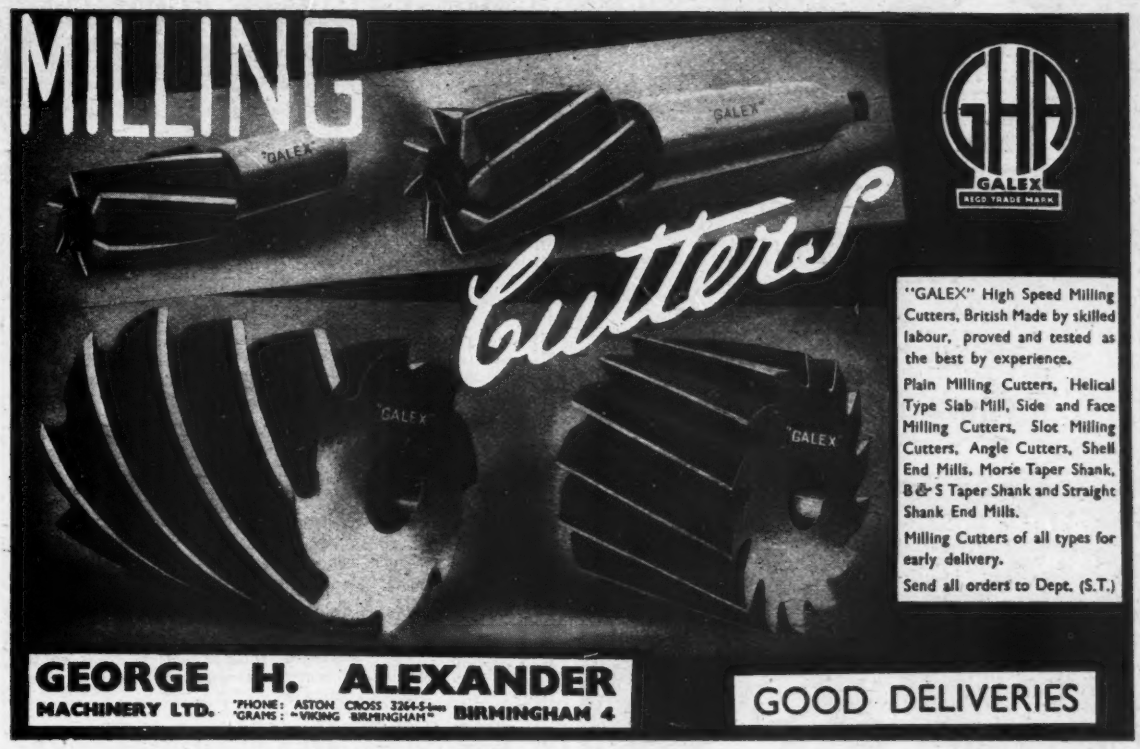
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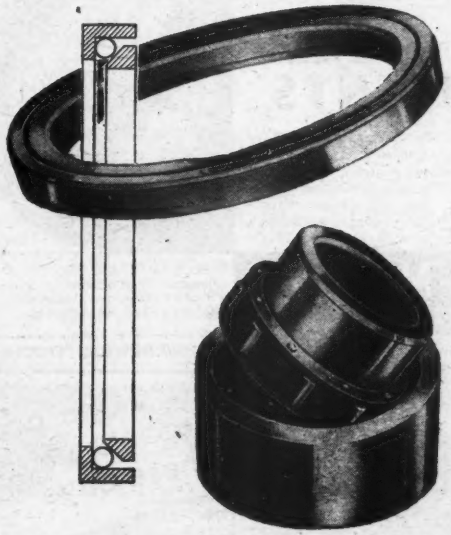

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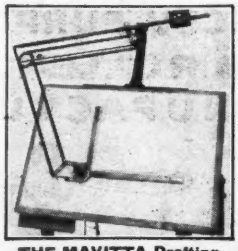

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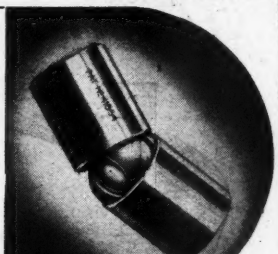

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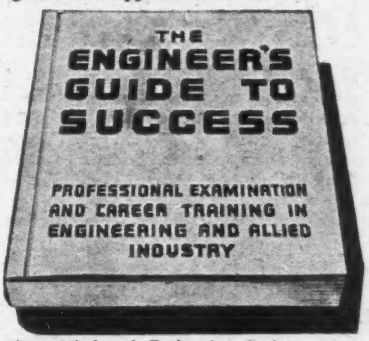

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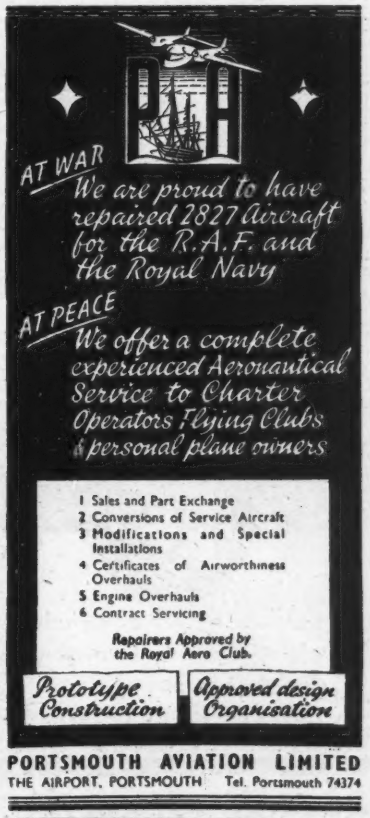
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FLT. Lt. R.A.F., Engineering Branch, age 33, ex-Halton apprentice, on release leave, requires employment in civil aviation; 13 years' engine and airframe experience (all types), 2 years A.I.D.; available immediately.—Box 543, c/o *Flight*. [7224

EX-AUSTRALIAN flying officer pilot, D.F.C., age 22, 880 hours singles, multis, ex-Lancaster instructor, studying B licence, seeks any position connected with flying, anywhere; available immediately; keen and willing to learn.—Box 544, c/o *Flight*. [7225

F/O. R.A.F. pilot, demob August, aero engineering diploma Loughborough College, Stud. I.P.E., S.M.L.A.E., service flying instructor, cat. "B," over 1,000 hrs., accident free, twins, singles, seeks design or experimental position in aircraft firm.—Box 611.

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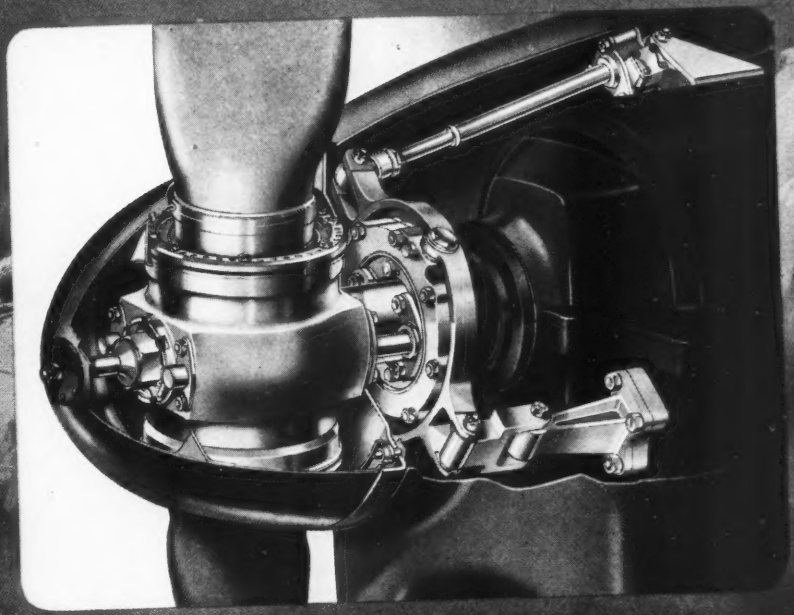

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